

HIGHWAY WORK PROPOSAL

Wisconsin Department of Transportation
DT1502 10/2010 s.66.29(7) Wis. Stats.

Proposal Number:

Ø 3

<u>COUNTY</u>	<u>STATE PROJECT ID</u>	<u>FEDERAL PROJECT ID</u>	<u>PROJECT DESCRIPTION</u>	<u>HIGHWAY</u>
La Crosse	1070-00-71	WISC 2016 045	La Crosse - Sparta Safety Rest Area No. 31	IH 90

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, \$ 75,000.00 Payable to: Wisconsin Department of Transportation	Attach Proposal Guaranty on back of this PAGE.
Bid Submittal Due Date: March 8, 2016 Time (Local Time): 9:00 AM	Firm Name, Address, City, State, Zip Code
Contract Completion Time May 19, 2017	SAMPLE NOT FOR BIDDING PURPOSES
Assigned Disadvantaged Business Enterprise Goal DISC %	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)

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

(Date Commission Expires)

Notary Seal

(Bidder Signature)

(Print or Type Bidder Name)

(Bidder Title)

For Department Use Only

Type of Work Excavation, base aggregate, concrete pavement, concrete curb and gutter, building removals, tree trimming and grubbing, sheet pile retaining wall, storm sewer, new rest area building, maintenance building, landscaping and site features.	
Notice of Award Dated	Date Guaranty Returned

**PLEASE ATTACH
PROPOSAL GUARANTY HERE**

Effective with November 2007 Letting

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.

Effective with August 2015 Letting

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:
<http://wisconsindot.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 P.M. local time on the Thursday before the letting. Check the department's web site after 5:00 P.M. 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 P.M. 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:
<http://wisconsindot.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 departments web site listed above or by picking up the addenda at the Bureau of Highway Construction, Room 601, 4802 Sheboygan Avenue, 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:
 1. Have a properly executed annual bid bond on file with the department.
 2. 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 ExpressTM web site.
 2. Use ExpediteTM software to enter a unit price for every item in the schedule of items.
 3. Submit the bid according to the requirements of ExpediteTM software and the Bid ExpressTM 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 ExpressTM web site reflecting the latest addenda posted on the department's web site at:
<http://wisconsindot.gov/Pages/doing-bus/contractors/hcci/bid-let.aspx>

Use ExpediteTM 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 ExpressTM web site to assure that the schedule of items is prepared properly.

- (2) Staple an 8 1/2 by 11 inch printout of the ExpediteTM 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 ExpediteTM 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 ExpediteTM 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.

C 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)

March 2010

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]

DECEMBER 2000

**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

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SPECIAL PROVISIONS

1. General.

Perform the work under this construction contract for Project 1070-00-71 La Crosse – Sparta, Safety Rest Area No. 31, IH 90, La Crosse County, 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, 2016 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 (20150630)

2. Scope of Work.

The work under this contract shall consist of excavation, base aggregate, concrete pavement, concrete curb and gutter, removals of existing structures, clearing and grubbing, sheet pile retaining wall, storm sewer, construction of new rest area building and maintenance building, landscaping and site features, 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 ten 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.

Substantially complete construction operations on the rest area building and facility to the stage necessary to reopen it to the traveling public prior to 12:01 AM November 18, 2016. Do not reopen until completing the following work: pavement and curb and gutter throughout the project; pavement marking, permanent signing, and lighting; new security fence and gate on the east side of the facility; all aspects of the new rest area building and maintenance building to be complete and operational; and all permanent sidewalk connections from the truck parking area and car parking area and plaza sidewalks to the building.

Complete construction operations, including landscaping and turf establishment, must be complete prior to 12:01 AM May 19, 2017.

Construction access only from CTH BW (Lakeshore Drive). There will be no access from IH 90 during construction unless approved by the engineer.

If the contractor fails to complete the work necessary to reopen the rest area facility to the traveling public prior to 12:01 AM November 18, 2016, the department will assess the contractor \$1,940 in interim liquidated damages for each calendar day that the rest area remains closed to the traveling public after 12:01 AM, November 18, 2016. An entire calendar day will be charged for any period of time within a calendar day that the rest area remains closed beyond 12:01 AM.

The department will not grant time extensions to the interim completion dates specified above for the following:

1. Severe weather as specified in standard spec 108.10.2.2.
2. Labor disputes that are not industry wide.
3. Delays in material deliveries.

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 and structures (bridges, culverts, buildings). 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.

The department has contracted with others to cut all trees for this project prior to construction. Remove any downed trees and grub the stumps and any remaining vegetation within the identified grubbing limits.

If additional trees need to be removed, no clearing shall occur without prior approval from the WisDOT Regional Environmental Coordinator (REC). Additional tree removal beyond the area originally specified will require consultation with the United States Fish and Wildlife Service (USFWS) and may require a bat presence/absence survey. Notify the project engineer if additional clearing cannot be avoided to begin coordination with the WisDOT REC. The WisDOT REC will initiate consultation with the USFWS and determine if a survey is necessary.

Submit a schedule and description of clearing and/or grubbing operations with the ECIP 14 days prior to any clearing operations. The department will determine, based on schedule and scope of work, what additional erosion control measures shall be implemented prior to the start of clearing operations, and list those additional measures in the approval letter for the ECIP.

4. Municipality Acceptance of Sanitary Sewer and Water Main Construction.

Both the department and Town of Campbell personnel will inspect construction of sanitary sewer under this contract. However, testing and acceptance of the sanitary sewer construction will be by the Town of Campbell.

105-001 (20140630)

5. Referenced Construction Specifications.

Construct the work enumerated below conforming to the SPS 360-366 Wisconsin Commercial Building Code. If there is a discrepancy or conflict between the referenced specification and the standard specifications regarding contract administration, part 1 of the standard specifications governs.

Conform to the referenced construction specifications for the following:

Construction of Rest Area Building and Maintenance Buildings.

105-002 (20130615)

6. Public Convenience and Safety.

Revise standard spec 107.8(6) as follows:

Check for and comply with local ordinances governing the hours of operation of construction equipment. Do not operate motorized construction equipment from 9:00 PM until the following 7:00 AM, unless prior written approval is obtained from the engineer.

107-001 (20060512)

7. Holiday Work Restrictions.

Do not perform work on, nor haul materials of any kind along or across any portion of the highway carrying County Road BW (Lakeshore Drive) 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 periods:

- From noon Friday, May 27, 2016 to 6:00 AM Tuesday, May 31, 2016 for Memorial Day;
- From noon Friday, July 1, 2016 to 6:00 AM Tuesday, July 5, 2015 for Independence Day;
- From noon Friday, September 2, 2016 to 6:00 AM Tuesday, September 6, 2016 for Labor Day.

107-005 (20050502)

8. Utilities.

This contract comes under the provisions of Wisconsin Administrative Code Chapter Trans 220.

107-065 (20080501)

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 owner. Follow-up with a confirmation notice to the engineer and the utility owner not less than three working days before the site will be ready for the utility owner to begin its work.

Coordinate all new rest area service connections during construction necessary to accomplish the work of this project. The following utility owners have facilities within the project limits, however no conflicts are anticipated with distribution facilities:

Town Of Campbell – sanitary sewer
CenturyLink – buried communication lines
Xcel Energy – overhead and buried electric, gas
WisDOT - light poles

The allowance for utility company charges for each of these utilities shall be as follows:

Telephone Service: \$1,500

Electrical Service: \$4,000

Natural Gas Service: \$6,500

9. Coordination with Businesses and Residents.

The contractor shall arrange and conduct a meeting between the contractor, the department, affected residents, local officials and business people to discuss the project schedule of operations including vehicular and pedestrian access during construction operations. Hold the first meeting at least one week prior to the start of work under this contract and no further meetings will be required unless directed by the engineer. The department will arrange for a suitable location for the meeting(s) that provides reasonable accommodation for public involvement. The department will prepare and coordinate publication of the meeting notices and mailings for the meeting(s). The contractor shall schedule the meeting(s) with at least two weeks prior notice to the engineer to allow for these notifications.

108-060 (20141107)

10. Geotechnical Investigation.

Replace standard spec 102.5(3) 2. with the following:

Available information relative to subsurface exploration, borings, soundings, water levels, elevations or profiles are available for review upon request from the Wisconsin Department of Transportation, contact Robert Spoerl (608) 266-8665.

- A. "Geotechnical Exploration and Analysis Report" prepared by Soils & Engineering Services, Inc. dated October 26, 2015 containing soil borings contains information that may be of use for the design of the sheet pile tie back anchors, the soil nail reinforced slope and requirements for pavements and building foundations.

The contractors are responsible to review the available information to determine if it is of use to the contractors. The use or not of the geotechnical information does not relieve the contractor from performing the work according to the plans and specifications.

11. Grubbing.

Replace the first sentence of standard spec 201.5 of the standard specification with the following:

The department will pay at plan quantity at the contract unit price under the following bid item.

12. Removing Pull Box, Item 204.9060.S.01.

A Description

This special provision describes removing pull box according to the pertinent provisions of standard spec 204 and as hereinafter provided.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Removing Pull Box as each unit acceptably completed.

E Payment

Add the following to standard spec 204.5:

ITEM NUMBER	DESCRIPTION	UNIT
204.9060.S	Removing Pull Box	Each

204-025 (20150630)

13. Removing Flag Pole, Item 204.9060.S.02.

A Description

This special provision describes removing flag pole according to the pertinent provisions of standard spec 204 and as hereinafter provided.

B (Vacant)

C (Vacant)

1070-00-71

D Measurement

The department will measure Removing Flag Pole as each unit, acceptably completed.

E Payment

Add the following to standard spec 204.5:

ITEM NUMBER	DESCRIPTION	UNIT
204.9060.S	Removing Flag Pole	Each

204-025 (20150630)

14. Removing Planter, Item 204.9060.S.03.**A Description**

This special provision describes removing planter according to the pertinent provisions of standard spec 204 and as hereinafter provided.

B (Vacant)**C (Vacant)****D Measurement**

The department will measure Removing Planter as each unit, acceptably completed.

E Payment

Add the following to standard spec 204.5:

ITEM NUMBER	DESCRIPTION	UNIT
204.9060.S	Removing Planter	Each

204-025 (20150630)

15. Removing Yard Hydrant and Supply Piping, Item 204.9060.S.04.**A Description**

This special provision describes removing yard hydrant and supply piping according to the pertinent provisions of standard spec 204 and as hereinafter provided.

B (Vacant)**C (Vacant)****D Measurement**

The department will measure Removing Yard Hydrant and Supply Piping as each unit, acceptably completed.

E Payment

Add the following to standard spec 204.5:

ITEM NUMBER	DESCRIPTION	UNIT
204.9060.S	Removing Yard Hydrant and Supply Piping	Each

204-025 (20150630)

16. Removing Sanitary Sewer Pipe 6-Inch, Item 204.9090.S.01; 8-Inch, Item 204.9090.S.02.**A Description**

This special provision describes removing sanitary sewer pipe (size) according to the pertinent provisions of standard spec 204 and as hereinafter provided.

B (Vacant)**C (Vacant)****D Measurement**

The department will measure Removing Sanitary Sewer Pipe (size) in linear feet, acceptably completed.

E Payment

Add the following to standard spec 204.5:

ITEM NUMBER	DESCRIPTION	UNIT
204.9090.S	Removing Sanitary Sewer Pipe (size)	LF

204-025 (20150630)

17. QMP Base Aggregate.**A Description****A.1 General**

- (1) This special provision describes contractor quality control (QC) sampling and testing for base aggregates, documenting those test results, and documenting related production and placement process changes. This special provision also describes department quality verification (QV), independent assurance (IA), and dispute resolution.
- (2) Conform to standard spec 301, standard spec 305, and standard spec 310 as modified here in this special provision. Apply this special provision to material placed under all of the Base Aggregate Dense and Base Aggregate Open Graded bid items, except do not apply this special provision to material classified as reclaimed asphaltic pavement placed under the Base Aggregate Dense bid items.

- (3) Do not apply this special provision to material placed under the Aggregate Detours, Salvaged Asphaltic Pavement Base, Breaker Run, Select Crushed, Pit Run, Subbase, or Riprap bid items.
- (4) Provide and maintain a quality control program, defined as all activities related to and documentation of the following:
 1. Production and placement control and inspection.
 2. Material sampling and testing.
- (5) Chapter 8 of the department's construction and materials manual (CMM) provides additional detailed guidance for QMP work and describes required sampling and testing procedures. The contractor may obtain the CMM from the department's web site at: <http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrcs/rdwy/default.aspx>

A.2 Contractor Testing for Small Quantities

- (1) The department defines a small quantity, for each individual Base Aggregate bid item, as a plan quantity of 9000 tons or less of material as shown in the schedule of items under that bid item.
- (2) The requirements under this special provision apply equally to a small quantity for an individual bid item except as follows:
 1. The contractor need not submit a full quality control plan but shall provide an organizational chart to the engineer including names, telephone numbers, and current certifications of all persons involved in the quality control program for material under affected bid items.
 2. Divide the aggregate into uniformly sized sublots for testing as follows:

Plan Quantity	Minimum Required Testing
≤ 1500 tons	One test from production, load-out, or placement at the contractor's option ^[1]
> 1500 tons and ≤ 6000 tons	Two tests of the same type, either from production, load-out, or placement at the contractor's option ^[1]
> 6000 tons and ≤ 9000 tons	Three placement tests ^{[2] [3]}

^[1] If using production tests for acceptance, submit test results to the engineer for review prior to incorporating the material into the work. Production test results are valid for a period of 3 years.

^[2] For 3-inch material, obtain samples at load-out.

^[3] If the actual quantity overruns 9000 tons, create overrun sublots to test at a rate of one additional placement test for each 3000 tons, or fraction of 3000 tons, of overrun.

3. No control charts are required. Submit aggregate load-out and placement test results to the engineer within one business day of obtaining the sample. Assure that all properties are within the limits specified for each test.

4. Department verification testing is optional for quantities of 6000 tons or less.

- (3) Material represented by a subplot with any property outside the specification limits is nonconforming. The department may reject material or otherwise determine the final disposition of nonconforming material as specified in standard spec 106.5.

B Materials

B.1 Quality Control Plan

- (1) Submit a comprehensive written quality control plan to the engineer at or before the pre-construction meeting. Do not place base before the engineer reviews and comments on the plan. Construct the project as that plan provides.
- (2) Do not change the quality control plan without the engineer's review. Update the plan with changes as they become effective. Provide a current copy of the plan to the engineer and post in each of the contractor's laboratories as changes are adopted. Ensure that the plan provides the following elements:
 1. An organizational chart with names, telephone numbers, current certifications and/or titles, and roles and responsibilities of QC personnel.
 2. The process used to disseminate QC information and corrective action efforts to the appropriate persons. Include a list of recipients, the communication means that will be used, and action time frames.
 3. A list of source and processing locations, section and quarter descriptions, for all aggregate materials requiring QC testing.
 4. Test results for wear, sodium sulfate soundness, freeze/thaw soundness, and plasticity index of all aggregates requiring QC testing. Obtain this information from the region materials unit or from the engineer.
 5. Descriptions of stockpiling and hauling methods.
 6. Locations of the QC laboratory, retained sample storage, and where control charts and other documentation is posted.
 7. An outline for resolving a process control problem. Include responsible personnel, required documentation, and appropriate communication steps.

B.2 Personnel

- (1) Have personnel certified under the department's highway technician certification program (HTCP) perform sampling, testing, and documentation as follows:

Required Certification Level:	Sampling or Testing Roles:
Aggregate Technician IPP Aggregate Sampling Technician Aggregate Assistant Certified Technician (ACT-AGG)	Aggregate Sampling ^[1]
Aggregate Technician IPP Aggregate Assistant Certified Technician (ACT-AGG)	Aggregate Gradation Testing, Aggregate Fractured Particle Testing, Aggregate Liquid Limit and Plasticity Index Testing

^[1] Plant personnel under the direct observation of an aggregate technician certified at level one or higher may operate equipment to obtain samples.

- (2) A certified technician must coordinate and take responsibility for the work an ACT performs. Have a certified technician ensure that all sampling and testing is performed correctly, analyze test results, and post resulting data. No more than one ACT can work under a single certified technician.

B.3 Laboratory

- (1) Perform QC testing at a department-qualified laboratory. Obtain information on the Wisconsin laboratory qualification program from:

Materials Management Section

3502 Kinsman Blvd.

Madison, WI 53704

Telephone: (608) 246-5388

<http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrcs/tools/appr-prod/qual-labs.aspx>

B.4 Quality Control Documentation

B.4.1 General

- (1) Submit base aggregate placement documentation to the engineer within 10 business days after completing base placement. Ensure that the submittal is complete, neatly organized, and includes applicable project records and control charts.

B.4.2 Records

- (1) Document all placement observations, inspection records, and control adjustments daily in a permanent field record. Also include all test results in the project records. Provide test results to the engineer within 6 hours after obtaining a sample. For 3-inch base, extend this 6-hour limit to 24 hours. Post or distribute tabulated results using a method mutually agreeable to the engineer and contractor.

B.4.3 Control Charts

- (1) Plot gradation and fracture on the appropriate control chart as soon as test results are available. Format control charts according to CMM 8.30. Include the project number on base placement control charts. Maintain separate control charts for each base aggregate size, source or classification, and type.
- (2) Provide control charts to the engineer within 6 hours after obtaining a sample. For 3-inch base, extend this 6-hour limit to 24 hours. Post or distribute charts using a method mutually agreeable to the engineer and contractor. Update control charts daily to include the following:
 1. Contractor individual QC tests.
 2. Department QV tests.
 3. Department IA tests.
 4. Four-point running average of the QC tests.
- (3) Except as specified under B.8.2.1 for nonconforming QV tests, include only QC tests in the running average. The contractor may plot process control or informational tests on control charts, but do not include these tests, conforming QV tests, or IA tests in the running average.

B.5 Contractor Testing

- (1) Test gradation, fracture, liquid limit and plasticity index during placement for each base aggregate size, source or classification, and type.

- (2) Test gradation once per 3000 tons of material placed. Determine random sample locations and provide those sample locations to the engineer. Obtain samples after the material has been bladed, mixed, and shaped but before compacting; except collect 3-inch samples from the stockpile at load-out. Do not sample from material used to maintain local traffic or from areas of temporary base that will not have an overlying pavement. On days when placing only material used to maintain local traffic or only temporary base that will not have an overlying pavement, no placement testing is required.
- (3) Split each contractor QC sample and identify it according to CMM 8.30. Retain the split for 7 calendar days in a dry, protected location. If requested for department comparison testing, deliver the split to the engineer within one business day.
- (4) The engineer may require additional sampling and testing to evaluate suspect material or the technician's sampling and testing procedures.
- (5) Test fracture for each gradation test until the fracture running average is above the lower warning limit. Subsequently, the contractor may reduce the frequency to one test per 10 gradation tests if the fracture running average remains above the warning limit.
- (6) Test the liquid limit and plasticity index for the first gradation test. Subsequently, test the liquid limit and plasticity index a minimum of once per 10 gradation tests.

B.6 Test Methods

B.6.1 Gradation

- (1) Test gradation using a washed analysis conforming to the following as modified in CMM 8.60:
Gradation..... AASHTO T 27
Material finer than the No. 200 sieve..... AASHTO T 11
- (2) For 3-inch base, if 3 consecutive running average points for the percent passing the No. 200 sieve are 8.5 percent or less, the contractor may use an unwashed analysis. Wash at least one sample out of 10. If a single running average for the percent passing the No. 200 sieve exceeds 8.5 percent, resume washed analyses until 3 consecutive running average points are again 8.5 percent passing or less.
- (3) Maintain a separate control chart for each sieve size specified in standard spec 305 or standard spec 310 for each base aggregate size, source or classification, and type. Set control and warning limits based on the standard specification gradation limits as follows:
 1. Control limits are at the upper and lower specification limits.
 2. There are no upper warning limits for sieves allowing 100 percent passing and no lower control limits for sieves allowing 0 percent passing.
 3. Dense graded warning limits, except for the No. 200 sieve, are 2 percent within the upper and lower control limits. Warning limits for the No. 200 sieve are set 0.5 percent within the upper and lower control limits.

4. Open graded warning limits for the 1-inch, 3/8-inch, and No. 4 sieves are 2 percent within the upper and lower control limits. Upper warning limits for the No. 10, No. 40, and No. 200 sieves are 1 percent inside the upper control limit.

B.6.2 Fracture

- (1) Test fracture conforming to CMM 8.60. The engineer will waive fractured particle testing on quarried stone.
- (2) Maintain a separate fracture control chart for each base aggregate size, source or classification, and type. Set the lower control limit at the contract specification limit, either specified in another special provision or in table 301-2 of standard spec 301.2.4.5. Set the lower warning limit 2 percent above the lower control limit. There are no upper limits.

B.6.3 Liquid Limit and Plasticity

- (1) Test the liquid limit and plasticity according to AASHTO T 89 and T 90.
- (2) Ensure the material conforms to the limits specified in standard spec table 301-2.

B.7 Corrective Action

B.7.1 General

- (1) Consider corrective action when the running average trends toward a warning limit. Take corrective action if an individual test exceeds the contract specification limit. Document all corrective actions both in the project records and on the appropriate control chart.

B.7.2 Placement Corrective Action

- (1) Do not blend additional material on the roadbed to correct gradation problems.
- (2) Notify the engineer whenever the running average exceeds a warning limit. When two consecutive running averages exceed a warning limit, the engineer and contractor will discuss appropriate corrective action. Perform the engineer's recommended corrective action and increase the testing frequency as follows:
 1. For gradation, increase the QC testing frequency to at least one randomly sampled test per 1000 tons placed.
 2. For fracture, increase the QC testing frequency to at least one test per gradation test.
- (3) If corrective action improves the property in question such that the running average after 4 additional tests is within the warning limits, the contractor may return to the testing frequency specified in B.5.3. If corrective action does not improve the property in question such that the running average after 4 additional individual tests is still in the warning band, repeat the steps outlined above starting with engineer notification.
- (4) If the running average exceeds a control limit, material starting from the first running average exceeding the control limit and ending at the first subsequent running average inside the control limit is nonconforming and subject to pay reduction.
- (5) For individual test results significantly outside the control limits, notify the engineer, stop placing base, and suspend other activities that may affect the area in question. The

engineer and contractor will jointly review data, data reduction, and data analysis; evaluate sampling and testing procedures; and perform additional testing as required to determine the extent of potentially unacceptable material. The engineer may direct the contractor to remove and replace that material. Individual test results are significantly outside the control limits if meeting one or more of the following criteria:

1. A gradation control limit for the No. 200 sieve is exceeded by more than 3.0 percent.
2. A gradation control limit for any sieve, except the No. 200, is exceeded by more than 5.0 percent.
3. The fracture control limit is exceeded by more than 10.0 percent.

B.8 Department Testing

B.8.1 General

- (1) The department will conduct verification testing to validate the quality of the product and independent assurance testing to evaluate the sampling and testing. The department will provide the contractor with a listing of names and telephone numbers of all QV and IA personnel for the project, and provide test results to the contractor within two business days after the department obtains the sample.

B.8.2 Verification Testing

B.8.2.1 General

- (1) The department will have an HTCP technician, or ACT working under a certified technician, perform QV sampling and testing. Department verification testing personnel must meet the same certification level requirements specified in B.2 for contractor testing personnel for each test result being verified. The department will notify the contractor before sampling so the contractor can observe QV sampling.
- (2) The department will conduct QV tests of each base aggregate size, source or classification, and type during placement conforming to the following:
 1. One non-random test on the first day of placement.
 2. At least one random test per 30,000 tons, or fraction of 30,000 tons, placed.
- (3) The department will sample randomly, at locations independent of the contractor's QC work, collecting one sample at each QV location. The department will collect QV samples after the material has been bladed, mixed, and shaped but before compacting; except, for 3-inch aggregates, the department will collect samples from the stockpile at load-out. The department will split each sample, test half for QV, and retain half.
- (4) The department will conduct QV tests in a separate laboratory and with separate equipment from the contractor's QC tests. The department will use the same methods specified for QC testing.
- (5) The department will assess QV results by comparing to the appropriate specification limits. If QV test results conform to the specification, the department will take no further action. If QV test results are nonconforming, add the QV to the QC test results as if it were an additional QC test.

B.8.3 Independent Assurance

- (1) Independence assurance is unbiased testing the department performs to evaluate the department's QV and the contractor's QC sampling and testing including personnel qualifications, procedures, and equipment. The department will perform an IA review according to the department's independent assurance program. That review may include one or more of the following:
 1. Split sample testing.
 2. Proficiency sample testing.
 3. Witnessing sampling and testing.
 4. Test equipment calibration checks.
 5. Reviewing required worksheets and control charts.
 6. Requesting that testing personnel perform additional sampling and testing.
- (2) If the department identifies a deficiency, and after further investigation confirms it, correct that deficiency. If the contractor does not correct or fails to cooperate in resolving identified deficiencies, the engineer may suspend placement until action is taken. Resolve disputes as specified in B.9.

B.9 Dispute Resolution

- (1) The engineer and contractor should make every effort to avoid conflict. If a dispute between some aspect of the contractor's and the engineer's testing program does occur, seek a solution mutually agreeable to the project personnel. The department and contractor may review the data, examine data reduction and analysis methods, evaluate sampling and testing procedures, and perform additional testing. Use ASTM E 178 to evaluate potential statistically outlying data.
- (2) Production test results, and results from other process control testing, may be considered when resolving a dispute.
- (3) If the project personnel cannot resolve a dispute, and the dispute affects payment or could result in incorporating non-conforming product, the department will use third party testing to resolve the dispute. The department's central office laboratory, or a mutually agreed on independent testing laboratory, will provide this testing. The engineer and contractor will abide by the results of the third party tests. The party in error will pay service charges incurred for testing by an independent laboratory. The department may use third party test results to evaluate the quality of questionable materials and determine the appropriate payment. The department may reject material or otherwise determine the final disposition of nonconforming material as specified in standard spec 106.5.

C (Vacant)

D (Vacant)

E Payment

- (1) Costs for all sampling, testing, and documentation required under this special provision are incidental to this work. If the contractor fails to perform the work required under this

special provision, the department may reduce the contractor's pay. The department will administer pay reduction under the non-performance of QMP administrative item.

- (2) For material represented by a running average exceeding a control limit, the department will reduce pay by 10 percent of the contract price for the affected Base Aggregate bid items listed in subsection A. The department will administer pay reduction under the Nonconforming QMP Base Aggregate Gradation or Nonconforming QMP Base Aggregate Fracture Administrative items. The department will determine the quantity of nonconforming material as specified in B.7.2.

301-010 (20151210)

18. Base Aggregate Dense 1¼-Inch for Lower Base Layers.

Replace standard spec 305.2.2.1(2) with the following:

1. Use 1¼-inch base throughout the full base depth.
2. Use ¾-inch base in the top 3 inches of the unpaved portion of shoulders. Use ¾-inch base or 1¼-inch base elsewhere in shoulders.

305-020 (20080902)

19. Pipe Grates, Item 611.9800.S.

A Description

This special provision describes furnishing and installing pipe grates on the ends of pipes as shown in the plans, and as hereinafter provided.

B Materials

Furnish steel conforming to the requirements of standard spec 506.2.2.1. Furnish steel pipe conforming to the requirements of standard spec 506.2.3.6.

Furnish pipe grates galvanized according to ASTM A123.

Furnish angles and brackets galvanized according to ASTM A123.

Furnish required hardware galvanized according to ASTM A153.

C Construction

Repair pipes, rods, angles and brackets on which the galvanized coating has been damaged according to the requirements of AASHTO M36M.

D Measurement

The department will measure Pipe Grates in units of work, where one unit is one grate, completed 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
611.9800.S	Pipe Grates	Each

Payment is full compensation for furnishing and installing all materials; and for drilling and connecting grates to pipes.
611-010 (20030820)

20. Insulation Board Polystyrene, 2-Inch, Item 612.0902.S.01.

A Description

This special provision describes furnishing and placing polystyrene insulation board as shown on the plans and as hereinafter provided.

B Materials

Provide polystyrene insulation board that conforms to the requirements for Extruded Insulation Board, AASHTO Designation M230, except as hereinafter revised.

Delete flammability requirement.

B.1 Certification

Before installation, obtain from the manufacturer a certification indicating compliance and furnish it to the engineer.

C (Vacant)

D Measurement

The department will measure Insulation Board Polystyrene (size) by area in square yards of work, completed 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
612.0902.S.01	Insulation Board Polystyrene 2-Inch	SY

Payment is full compensation for furnishing all excavation; and for furnishing and placing the insulation board.
612-005 (20030820)

21. Landscape Planting Surveillance and Care Cycles.

If the care specialist fails to perform any of the required care cycles as specified in standard spec 632.3.19.1, the department will assess daily damages in the amount of \$100 to cover the cost of performing the work with other forces. The department will assess these damages for each day the requirements of the care cycle remain incomplete, except when the engineer extends the required time period.

632-005 (20070510)

22. Intelligent Transportation Systems – Conduit.

Add the following to standard spec 671.2:

671.2.4 Locate Wire

Furnish and install a No. 14 AWG stranded copper wire for future locate purposes through each conduit run. Connect the locate wire by using a wire nut at each pull box, manhole, or other access point. Alternatively, use a single wire through the access points. All material furnished under this item shall meet the requirements of standard spec 655.

671-005 (20150630)

23. Picnic Tables Single Pedestal, Item 999.1800.S.

A Description

This special provision describes furnishing and installing picnic tables according to the plans and as hereinafter provided.

B Materials

B.1 Recycled Plastic Planks

Provide planks that meet the following requirements:

1. Planks shall be made from 95% post-consumer or post-industrial recycled type 2 HDPE plastic.
2. Plastic shall be impregnated with finish color and protected with a UV inhibitor to prevent fade.
3. Color shall be dark brown or a shade of dark red brown color, and shall be uniform for all planks within a table unit.
4. Plastic shall be able to sustain normal loadings at temperatures ranging from -26 degrees to 100 degrees Fahrenheit without cracking or excessive warping.

Plastic shall be subject to the approval from the engineer.

B.2 Structural Steel Frame

All steel tubes shall be ASTM A500 Grade B, cold-formed electric resistance welded tubing; all other steel shall be minimum ASTM A36M.

B.3 Hardware

Provide bolts that are galvanized steel carriage-type bolts of the sizes specified on the plan.

B.4 Paint

Use one of the following paint systems: Rust-Oleum 9300 System Heavy-Duty Epoxy finish with a 9334 Zinc Rich primer; Sherwin Williams Hi-Solids Catalyzed Epoxy finish with a Zinc Rich primer; or Devoe Tru-Glaze-3 Epoxy Gloss Coating with a Zinc Rich primer.

C Construction

C.1 Steel Fabrication

All welding of structural steel shall conform to the requirements of these specifications and to AASHTO/AWS D 1.2, under structural steel and angle iron of the Bridge Welding Code.

C.2 Painting

Prior to painting, clean by sandblasting all metal including miscellaneous structural steel to a SSPC-10, commercial blast finish.

Paint all metal with an epoxy paint over a zinc rich primer. Use primer and finish coat paint that is from the same manufacturer and primer recommended for use with finish coat.

Shop-apply the primer and the first coat. Field-apply the second finish coat after erection of the picnic table.

Perform all painting in strict compliance to the paint manufacturer's instructions for surface preparation and application requirements.

D Measurement

The department will measure Picnic Tables Single Pedestal, completed according to the contract and accepted, as a unit.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
999.1800.S	Picnic Tables Single Pedestal	Each

Payment is full compensation for constructing, furnishing, hauling, installing tables; and painting.

999-015 (20030820)

24. Tree, Shrub, and Groundcover Watering, Item SPV.0005.01.

A Description

This work includes temporary tree, shrub and groundcover watering at the locations shown on the plans and according to the requirements of standard specs 630, 631 and 632, the plans, and as hereinafter provided.

B Materials

Provide clean, contaminant-free water for tree, shrub, and groundcover watering. Water trees, shrubs, and groundcover as required per plant material supplier specifications.

C Construction

Maintain according to the standard specifications.

D Measurement

The department will measure Tree, Shrub and Groundcover Watering by the acre for installation, 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.0005.01	Tree, Shrub, and Groundcover Watering	Acre

Payment is full compensation for furnishing and installing all materials; furnishing and placing water; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

25. Tree Trimming, Item SPV.0005.02.

A Description

This work includes cutting trees, brush, windfalls, logs, and other vegetation occurring within the designated limits.

B (Vacant)

C Construction

Maintain in accordance to standard specification 201. In addition, clear shrubs, brush and low hanging branches up to an approximate elevation of 25 feet above existing grade in the special clearing area adjacent to French Slough designated in the plans. The sight lines shown in the plan at this special tree trimming area are approximate and will be determined during construction by the engineer. All work under this section shall be completed between the dates of October 1 to March 31.

D Measurement

The department will not measure Tree Trimming. The department will use pay plan quantity according to standard spec 109.1.1.2.

E Payment

The department will pay plan quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0005.02	Tree Trimming	Acre

Payment is full compensation for all tree trimming and brush clearing required under this section and performed within the limits designated on the plans; handling, hauling, piling, burning, burying, trimming, chipping, wound treatment, re-handling, and disposing of waste and debris; and excavations made to bury trimming and clearing material, backfilling these excavations, and disposing of excess excavated material. Tree trimming work in the Pet Exercise Area shall be incidental to this item.

26. Double Shredded Hardwood Mulch, Item SPV.0035.01.

A Description

Furnish and install double-shredded hardwood mulch at the locations shown on the plans, according to the requirements of standard spec 627, the plans, and as hereinafter provided.

B Materials

Provide as per the standard specifications.

C Construction

Install as shown on the plans and as per the standard specifications.

D Measurement

The department will measure Double Shredded Hardwood Mulch by the cubic yard of mulch, acceptably placed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0035.01	Double Shredded Hardwood Mulch	CY

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

27. Planter Soil, Item SPV.0035.02.**A Description**

Furnish and install planter soil at the locations shown on the plans, according to the requirements of standard spec 625, the plans, and as hereinafter provided.

B Materials

- 1/3 Pulverized Top Soil
- 1/3 Decomposed Leaf Compost
- 1/3 Clean Sand

C Construction

Install as shown on the plan and as per the standard specifications.

D Measurement

The department will measure Planter Soil by the cubic yard of topsoil, 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.0035.02	Planter Soil	CY

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

28. Engineered Soil, Item SPV.0035.03.**A Description**

Furnish and install engineered soil at the locations shown in the plans.

B Materials

- 70% Clean Sand
- 30% Compost

Engineered soil to be mixed offsite and the contractor shall submit a verification of the mix components to the engineer before placement. Mix components shall conform to the requirements of Wisconsin DNR Technical Standard 1004.

C Construction

Install as shown in the plans. Do not compact the engineered soil. The contractor must keep heavy machinery off the engineered soil once it is placed.

D Measurement

The department will measure Engineered Soil by the cubic yard, 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.0035.03	Engineered Soil	CY

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

29. Limestone Screenings, Item SPV0035.04.**A Description**

Furnish and install limestone screenings at the locations shown in the plans.

B Materials

Granular material used for limestone screenings shall conform to the following grading requirements:

Sieve Size	% Passing by Weight
3/8"	100
No. 4	90-100
No. 8	55-80
No. 16	40-70
No. 30	25-50
No. 200	6-15

C Construction

Install as shown in the plans.

D Measurement

The department will measure Limestone Screenings by the cubic yard, 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
SPV0035.04	Limestone Screenings	CY

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

30. Telephone Service, Item SPV.0055.01.**A Description**

This special provision describes the work by utility and contractor as required to provide underground telephone service from tie-in at existing to the new rest area building.

B (Vacant)**C Construction**

Contractor shall make all arrangements and coordinate telephone utility work with CenturyLink.

Utility will provide telephone service to the rest area building and traffic counter.

The allowance for telephone utility company charges as specified under special provision "Utilities" shall be incorporated into the bid price for this bid item. Final price shall be adjusted, if necessary, by contract change order whenever the utility company charge is more than or less than the stated allowance.

Contractor shall include all other work not incorporated into the utility allowance but necessary for complete installation.

D Measurement

The department will measure Telephone Service by the dollar, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0055.01	Telephone Service	DOL

Payment is full compensation for providing underground telephone service from tie-in at existing to new Rest Area Building and traffic counter; furnishing and installing all telephone cable, pedestals and network interface devices, and associated coordination; and for furnishing all labor, material, equipment, tools, and incidentals necessary to complete

the work as specified herein, subject to final price adjustments for items covered by contract allowances.

31. Electrical Service, Item SPV.0055.02.

A Description

This special provision describes the work by Utility and contractor as required to provide electrical service from existing source to the meter at the Rest Area Building, according to the plans and as hereinafter provided. Electrical service shall include underground three-phase power to the site and to transformers near the proposed building, including furnishing and installation of transformers and transformer pads; underground three phase service to the new rest area building; wire and terminations at transformers and at meter sockets; and meters.

Site lighting; site telephone work, and telephone wiring and equipment within the Rest Area Building; electrical work and equipment within the Rest Area Building including the meter socket, conduit, and Rest Area Building electrical system terminations at the main switch; and exterior conduit stub from the meter are included under other bid items.

B (Vacant)

C Construction

Contractor shall make all arrangements and coordinate electric utility service work with Xcel Energy.

Utility will provide transformers and transformer pads; wire; and all terminations at tie-in to existing, at transformers and at meter socket; and shall provide and install the meters.

The allowance for electric utility company charges as specified under special provision "Utilities" shall be incorporated into the bid price for this bid item. Final price shall be adjusted, if necessary, by contract change order whenever the utility company charge is more than or less than the stated allowance.

Include all other work not incorporated into the utility allowance but necessary for complete installation.

D Measurement

The department will measure Electrical Service by the dollar, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0055.02	Electrical Service	DOL

Payment is full compensation for providing underground three phase electric service from existing source to transformer near new Rest Area Building, transformers, transformer pads, and all associated coordination; and for furnishing all labor, material, equipment, tools, and

incidentals necessary to complete the work as specified herein, subject to final price adjustments for items covered by contract allowances.

32. Natural Gas Service, Item SPV.0055.03.

A Description

This special provision describes the work by utility and contractor as required to provide underground gas service from tie-in at existing to the new rest area building.

B (Vacant)

C Construction

Contractor shall make all arrangements and coordinate gas utility work with Xcel Energy.

Utility will provide gas service to the rest area building.

The allowance for gas utility company charges as specified under special provision "Utilities" shall be incorporated into the bid price for this bid item. Final price shall be adjusted, if necessary, by contract change order whenever the utility company charge is more than or less than the stated allowance.

Contractor shall include all other work not incorporated into the utility allowance but necessary for complete installation.

D Measurement

The department will measure Natural Gas Service by the dollar, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0055.03	Natural Gas Service	DOL

Payment is full compensation for providing underground gas service from tie-in at existing to new Rest Area Building; furnishing and installing all gas pipeline, gas meter, and associated coordination; and for furnishing all labor, material, equipment, tools, and incidentals necessary to complete the work as specified herein, subject to final price adjustments for items covered by contract allowances.

33. Gates, Chain Link Slatted, 8-FT, Item SPV.0060.01; 12-FT, Item SPV.0060.02.

A Description

Furnish and install slatted chain-link fence gates of the specified width according to the pertinent requirements of standard spec 616, the details on the plans, the pertinent requirements of "Fence Chain Link Slatted 8-FT" as specified in these special provisions, and as hereinafter provided.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Gates, Chain Link Slatted (Width) by each unit, completed 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.0060.01	Gates, Chain Link Slatted, 8-FT	Each
SPV.0060.02	Gates, Chain Link Slatted, 12-FT	Each

Payment is full compensation for furnishing all materials; for erecting gates, including all hauling, clearing, excavation, placing concrete footings, setting posts, placing braces and fitting, installing plunger rod and plunger rod catch, attaching wire fabric and inserting slats; for removal and disposal of all debris and excess excavation; and for furnishing all incidentals necessary to complete this item of work.

34. Pitless Adapter, Item SPV.0060.03.

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.0060.03	Pitless Adapter	Each

Payment is full compensation for furnishing and installing all materials; testing the adapter; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the contract work.

35. Well Pump, Item SPV.0060.04.

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

B.1 Pump

The well shall be capable of producing 82 gpm of acceptable water. Furnish a pump that is, capable of producing a minimum of 82 gpm, as measured at the pressure tank discharge, against a tank pressure range of 50 to 70 psi.

Furnish pumps manufactured by 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.

On Rest Area 31, the well pumps shall be located approximately 80 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.0060.04	Well Pump	Each

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the contract work.

36. Salvaged Trash Receptacles, Item SPV.0060.05.

A Description

Salvage existing trash receptacles from Rest Area 31 (currently stored at a secure location on site), store them in a safe place during construction, and move them to new locations as designated on the plans or as directed by the engineer.

B (Vacant)

C Construction

Salvage existing trash receptacles and relocate to a safe location in such a manner as to avoid damaging the receptacles. After construction is complete such that the receptacles can be safely installed, move them in such a manner as to avoid damage to the locations designated on the plans or as directed by the engineer.

D Measurement

The department will measure Salvaged Trash Receptacles, completed and accepted, by each unit.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.05	Salvaged Trash Receptacles	Each

Payment is full compensation for moving, storing and protecting the receptacles during construction; moving the receptacles to their new locations; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the contract work.

37. Salvaged Cigarette Snuffers, Item SPV.0060.06.

A Description

Salvage existing cigarette snuffers from Rest Area 31 (currently stored at a secure location on site), store them in a safe place during construction, and move them to new locations as designated on the plans or as directed by the engineer.

B (Vacant)

C Construction

Salvage existing cigarette snuffers and relocate to a safe location in such a manner as to avoid damaging the snuffers. After construction is complete such that the snuffers can be safely installed, move them in such a manner as to avoid damage to the locations designated on the plans or as directed by the engineer.

D Measurement

The department will measure the Salvaged Cigarette Snuffers, completed and accepted, by each unit.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.06	Salvaged Cigarette Snuffers	Each

Payment is full compensation for moving, storing and protecting the snuffers during construction; moving the snuffers to their new locations; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the contract work.

38. Flagpoles, Item SPV.0060.07.**A Description**

Furnish and install new aluminum flagpoles and concrete bases as shown on the plans and as hereinafter provided.

B Materials**B.1 Flagpoles**

Provide cone-tapered aluminum flagpoles with 35-foot exposed height.

Fabricate flagpoles from seamless extruded aluminum tubing, alloy 6063-T6, having a minimum wall thickness of 0.125", tensile strength not less than 25,000 psi and a yield point of 25,000 psi. Heat-treat and age-harden flagpoles.

Taper shall be manufacturer's standard seamless, uniform, straightline tapered section above a cylindrical butt section. Provide flagpole with uniform conical tapered section of 1 inch to each 5.5 feet of run.

B.2 Base

Provide manufacturer's standard embedded base system for the type of flagpole installation required. Provide 16-gauge minimum galvanized corrugated steel tube, or 12-gauge rolled steel tube, sized to suit the flagpole and installation. Furnish complete with welded steel bottom base and support plate, lightning ground spike, and steel centering wedges, all welded construction. Provide loose hardwood wedges at top for plumbing pole after erection. Galvanize steel parts after assembly, including foundation tube.

B.3 Finish

Provide a very fine, non-directional, mechanical polish, natural clear anodized finish complying with AA-C22A41, Class I (0.7 mil).

B.4 Flagpole Fittings

Provide the following accessories specifically intended for flagpoles furnished.

Ball - Flush seam 14 gauge spun aluminum, to match pole, sized to match butt diameter of shaft.

Truck - Aluminum ball-bearing, non-fouling, revolving, double-truck assembly.

Cleats - One internally mounted, cam-action cleat with internal sheave, factory mounted.

Halyards - One set of min. #10 (5/16") waterproof white polypropylene, equipped with two chrome swivel-snaps to secure the flag, one 3-1/2" neoprene coated counterweight and one beaded nylon retainer ring.

Collar - Spun aluminum finished to match flagpole with diameter 1 inch greater than diameter of sheave.

B.5 Concrete Masonry

Concrete masonry shall be according to the requirements of standard spec 501 for Grade A, A-S, A-FA, or A-IP.

C Construction

Spiral wrap each flagpole with heavy Kraft paper or other suitable wrapping, and burlap covering, wood-strip, and steel-band prior to shipment.

Deliver flagpoles and accessories completely identified for installation procedure. Handle and store flagpoles to prevent damage or soiling.

Install flagpoles in compliance to the plans and the manufacturer's instructions. Paint all portions of flagpole below grade with a heavy coat of bituminous paint.

Provide positive lightning ground for each flagpole installation.

D Measurement

The department will measure Flagpoles by each unit, complete 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.0060.07	Flagpoles	Each

Payment is full compensation for furnishing all materials; for installation; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

39. Benches, Item SPV.0060.08.

A Description

Furnish and install benches as shown on the plans and as hereinafter provided.

B Materials

Furnish benches from one of the following manufacturers (or approved equal):

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1. Landscape Forms “Arcata” backed bench, no arms, (www.landscapeforms.com).
 - -IPE wood seating surface
 - -Surface mount
 - -Steel Frame with factory applied Powdercoat finish: color- black
2. Victor Stanley “Production Collection” (www.victorstanley.com)
 - -6’ Length
 - -Black color
 - -Gray recycled plastic slat seating
3. Keystone Ridge “Robinson” with back (www.keystoneridgedesigns.com)
 - -Model RB26
 - -IPE sustainable hardwood slats

C Construction

Install benches as indicated on the plans or as directed by the engineer.

Surface mount with non-corrosive anchoring hardware, 7/16” diam. mounting hole.

D Measurement

The department will measure Benches by each unit complete 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.0060.08	Benches	Each

Payment is full compensation for furnishing all materials; for installation; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

40. Trash Receptacles, Item SPV.0060.09.

A Description

This work shall consist of furnishing and installing trash receptacles, complete and in place, at the locations as designated on the plans or as directed by the engineer.

B Materials

Trash receptacles shall be steel reinforced concrete with a smooth, weatherstone finish and sand color. Trash receptacles shall be of 53 gallon capacity and shall have a plastic cover with flip type opening. Furnish five sets of catalogue cut and manufacturer’s shop drawings to the engineer for approval before ordering.

Acceptable manufacturers are listed below (or approved equal):

- Wausau Made
P.O. Box 1520
Wausau, WI 54402-1520
(800) 388-8728

- Environmental Features, Inc.
- Quick Crete Products

C Construction

Install trash receptacles in locations indicated on the plans or as directed by the engineer.

D Measurement

The department will measure Trash Receptacles by each unit in place, completed 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.0060.09	Trash Receptacles	Each

Payment is full compensation for furnishing, hauling and installing trash receptacles; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work according to the contract.

41. Salvaged Recycle Receptacles, Item SPV.0060.10.

A Description

Salvage existing recycle receptacles from Rest Area 31 (currently stored at a secure location on site), store them in a safe place during construction, and move them to new locations as designated on the plans or as directed by the engineer.

B (Vacant)

C Construction

Salvage existing recycle receptacles and relocate to a safe location in such a manner as to avoid damaging the receptacles. After construction is complete such that the receptacles can be safely installed, move them in such a manner as to avoid damage to the locations designated on the plans or as directed by the engineer.

D Measurement

The department will measure Salvaged Recycle Receptacles, completed and accepted, by each unit.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.10	Salvaged Recycle Receptacles	Each

Payment is full compensation for moving, storing, and protecting the receptacles during construction; moving receptacles to a new location; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work according to the contract.

42. Walkway Lighting Units, Item SPV.0060.11.

A Description

Furnish and install bases, posts, and fixtures for walkway lighting units at the locations shown on the plans and according to standard spec 659, the plans, and as hereinafter provided.

B Materials

Furnish product specified on electrical site plans, fixture type LED-E. See electrical site plans for IES distribution. See lighting specification section 265100 of Building Specifications for further requirements.

C Construction

Follow all manufacturer's recommendations.

D Measurement

The department will measure Walkway Lighting Units by each 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.0060.11	Walkway Lighting Units	Each

Payment is full compensation for furnishing and installing all materials' furnishing and installing fixture; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

43. Sanitary Sewer Manhole, 4-FT, Item SPV.0060.12.

A Description

A.1 General

Construct precast concrete sanitary sewer manhole, including excavating, backfilling, and compacting, in the location shown on the plans or as determined by the engineer.

A.2 Submittals

Submit five copies of shop drawings for the precast concrete manhole.

B Materials

B.1 Manhole

Precast reinforced concrete manhole shall meet the requirements of ASTM C478. Joint shape shall be compatible with designated joint materials. Steps and pipe seal components shall be cast into riser sections.

Joints shall have rubber ring or plastic gasket material. Rubber gaskets shall conform to the requirements of ASTM C443. Plastic gaskets shall be preformed, high adhesion material, packaged ready for use between protective paper strips, conforming to Fed. Spec. SS-S-00210, Type I, Rope Form; Ram Nek, Kent Seal No. 2, or equal.

Pipe seals shall be flexible, watertight, gasket seals for pipe entrance holes; Press-Seal/Press Wedge I or PSX, Scales/Res-Seal, or equal.

B.2 Castings and Covers

Castings for manhole frame and covers shall be cast iron, ASTM A48, Class 30, of uniform quality, free from cracks or other defects. Type of castings shall be as designated on detail sheets, or approved equal. Covers shall have self-sealing neoprene O-ring gaskets and concealed pick holes. Manhole steps shall be ASTM C478 cast iron or steel-reinforced copolymer polypropylene.

B.3 Stone Bedding

The stone bedding shall conform to the requirements for crushed stone specified under bid item "Sanitary Sewer PVC (size)."

C Construction

Construct sanitary sewer manhole of precast reinforced concrete according to details on the plans. Construct drop manholes, where required on the plans, according to the requirements of Section 3.5.8(d)1 of the Standard Specifications for Sewer and Water Construction in Wisconsin.

Excavate as necessary to place precast concrete manhole on a firm and level base. Remove all undesirable material, which cannot support the structure below the normal base bottom, and replace with stone bedding as directed by the engineer.

Join risers, top sections, adjusting rings, and castings using compatible rubber rings or plastic gasket material. When plastic gasket material is used, joining surfaces shall receive manufacturer's approved primer as required. Ensure gasket material forms a tightly packed, watertight seal in annular joint space.

Bring manhole frames to existing grade and embed in a mortar course. Trowel-finish the inner face of this mortar joint.

Backfill and compact soils around the sanitary sewer manhole to Standard Proctor density specified for adjacent piping.

D Measurement

The department will measure Sanitary Sewer Manhole, 4-FT 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.0060.12	Sanitary Sewer Manhole 4-FT	Each

Payment is full compensation for furnishing all excavation, backfilling, and compacting; for furnishing and installing all materials, including precast reinforced concrete structure, frame and covers, and stone bedding; and for furnishing all tools, equipment, labor, and incidentals necessary to complete the work.

44. Moving Historical Sign, Item SPV.0060.13.

A Description

Two historical signs have been removed and are stored on site. Remove all existing historical sign framework structures (as located on the plan) including 6" x 6" posts and 2" x 6" horizontal members and hardware, as directed by the engineer. Remove pieces carefully as to avoid damage. Install two new signs, using salvaged framework materials and signs per WisDot Historical Marker Construction Details, Dimensioned Post Construction.

B Materials

Use salvaged framework materials (6"x 6" posts, 2"x 6" horizontal members) and historical signs. Use new hardware per WisDot Historical Marker Construction Details, Dimensioned Post Construction. Materials to be evaluated and approved by engineer prior to construction.

C Construction

Install two signs as shown on the WisDot Historical Marker Construction Details, Dimensioned Post Construction.

D Measurement

The department will measure Moving Historical Sign by each unit, 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.0060.13	Moving Historical Sign	Each

Payment is full compensation for furnishing and installing all materials and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

45. Wall Mounted Lighting Fixture, Item SPV.0060.14.

A Description

Furnish and install fixtures for wall mounted lighting fixtures at the locations shown on the plans and according to standard spec 659, the plans, and as hereinafter provided.

B Materials

Furnish product specified on electrical site plans, fixture type LED-H. See lighting specification section 265100 of Building Specifications for further requirements.

C Construction

Wall mounted light fixture shall be mounted to wiring box and oriented with optics down. Coordinate installation and exact location of fixture and conduit with general contractor prior to construction of wall.

Follow all manufacturer's recommendations. See lighting specification section 265100 of Building Specifications for further requirements.

D Measurement

The department will measure Wall Mounted Lighting Fixtures by each 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.0060.14	Wall Mounted Lighting Fixtures	Each

Payment is full compensation for furnishing and installing all materials' furnishing and installing fixture; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

46. Moving Veterans Sign, Item SPV.0060.15.**A Description**

Remove and store one veteran's sign as shown on the plans and as directed by the engineer. Remove sign carefully as to avoid damage. Install veteran's sign at the location on the plans and according to the requirements of standard spec 634 and 636, the plans and as hereinafter provided.

B Materials

Use salvaged veteran's sign. Furnish concrete for footings per standard specifications.

C Construction

Install veteran's sign as shown on the plan and as per the standard specifications.

D Measurement

The department will measure Moving Veterans Sign by each unit, 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.0060.15	Moving Veterans Sign	Each

Payment is full compensation for furnishing and installing all materials and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

47. Pet Waste Station, Item SPV.0060.16.

A Description

Furnish and install pet waste stations, complete and in place, at the locations as designated on the plans or as directed by the engineer. Mounting posts and concrete footings are to be according to the requirements of standard spec 634 and 636.

B Materials

Provide trash receptacles as per the detail shown on the plans. In addition, provide the following:

- -Pet waste stations by:
 1. Stinkies (www.stinkies.net)
 2. Baggit Outhouse Pet Station (www.baggitrwe.com)
 3. Doodycalls (www.doodycalls.com) or approved equal.
- -Poured in place concrete footings
- -Galvanized steel posts, clamps and mounting brackets

C Construction

Install pet waste stations as indicated on the plans, as per manufacturer's specifications or as directed by the engineer.

D Measurement

The department will measure Pet Waste Stations by each 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.0060.16	Pet Waste Station	Each

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

48. Picnic Shelter, Item SPV.0060.17.

A Description

Construct the picnic shelters unless specifically covered under other bid items. This work includes the general construction and electrical systems required to complete these structures according to the applicable plans, the 'General Requirements for Building Construction', and the technical specifications included the articles for the following bid items:

- Item SPV.0105.02, Rest Area 31 Building General Construction
- Item SPV.0105.05, Rest Area 31 Building Electrical

B (Vacant)

C (Vacant)

D Measurement

The department will measure Picnic Shelter by each unit, acceptably completed in place.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.17	Picnic Shelter	Each

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work. This bid item does not include exterior concrete slab or other general construction items, except as specifically noted. Work around the structures is to be measured and paid for under other applicable bid items.

49. Portable Planters, Item SPV.0060.18.**A Description**

Furnish and install pre-cast concrete planter, complete and in place, at the locations as designated on the plans or as directed by the engineer.

B Materials

Provide buff-colored, reinforced precast concrete planter. The planter shall have weatherstone finish and be of circular shape. Outside dimensions shall be 48" diameter by 24" high.

Precast concrete shall be constructed with Portland cement according to ASTM C150. All aggregated to meet ASTM C33 specifications, to be cleaned of foreign matter and properly graded to size. All precast products for this item shall be of one manufacturer.

Possible manufacturers include:

- Wausua Tile Inc.
P.O. Box 1520
Wausau, WI 54402-1520
(800) 992-8728
SL403 Planter
- Parkitecture
2475 Maplewood Drive
Suite 114
St. Paul, MN 55109
- Doty & Sons
1275 East State Street
Sycamore, IL 60178

C Construction

Install the tile planters as indicated on the plans, according to manufacturer's specifications or as directed by the engineer.

D Measurement

The department will measure the Portable Planters by each 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.0060.18	Portable Planters	Each

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

50. Gabion Planter Wisconsin Sign, Item SPV.0060.19; Gabion Planter Saw Blade, Item SPV.0060.20; Gabion Planter Trees, Item SPV.0060.21.

A Description

This bid item includes all work that is required for constructing the raised planters, unless some work is specifically covered under other bid items. This work includes the general construction and electrical systems required to complete these raised planters according to the applicable plans, the "General Requirements for Building Construction", standard spec 506 and the technical specifications included in the articles for the following bid items:

- Item SPV.0105.02, Rest Area 31 Building General Construction
- Item SPV.0105.05, Rest Area 31 Building Electrical

B Materials

Weathering steel shall be ASTM A588

C Construction

Provide shop drawings which specify material sizes, shapes, plan sections, install details and finishes per plans.

D Measurement

The department will measure the Gabion Planter Wisconsin Sign, Gabion Planter Saw Blade, and Gabion Planter Trees by each unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.19	Gabion Planter Wisconsin Sign	Each
SPV.0060.20	Gabion Planter Saw Blade	Each
SPV.0060.21	Gabion Planter Trees	Each

Payment is full compensation for furnishing and installing all materials; and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

51. Gabion Column, Item SPV.0060.22.

A Description

This bid item includes all work that is required for constructing the ornamental gabion columns, unless some work is specifically covered under other bid items. This work includes the general construction and electrical systems required to complete these columns according to the applicable plans, the “General Requirements for Building Construction”, and the technical specifications included in the articles for the following bid items:

- Item SPV.0105.02, Rest Area 31 Building General Construction
- Item SPV.0105.05, Rest Area 31 Building Electrical

B (Vacant)

C Construction

Provide shop drawings which specify material sizes, shapes, plan sections, install details and finishes per plans.

D Measurement

The department will measure the Gabion Column by each unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.22	Gabion Column	Each

Payment is full compensation for furnishing and installing all materials, and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

52. Linear Gabion Planter, Item SPV.0060.23; Curved Gabion Planter, Item SPV.0060.24.

A Description

This bid item includes all work that is required for constructing the planters, unless some work is specifically covered under other bid items. This work includes the general construction and electrical systems required to complete these raised planters according to the applicable plans, the “General Requirements for Building Construction”, standard spec 506 and the technical specifications included in the articles for the following bid items:

- Item SPV.0105.02, Rest Area 31 Building General Construction
- Item SPV.0105.05, Rest Area 31 Building Electrical

B Materials

Weathering steel shall be ASTM A588

C Construction

Provide shop drawings which specify material sizes, shapes, plan sections, install details and finishes per plans.

D Measurement

The department will measure the Linear Gabion Planter and Curved Gabion Planter by each unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.23	Linear Gabion Planter	Each
SPV.0060.24	Curved Gabion Planter	Each

Payment is full compensation for furnishing and installing all materials; and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

53. Gabion Column Interpretive Sign, Item SPV.0060.25.**A Description**

This bid item includes all work that is required for constructing the ornamental gabion sign bases, unless some work is specifically covered under other bid items. This work includes the general construction and electrical systems required to complete these sign bases according to the applicable plans, the "General Requirements for Building Construction", and the technical specifications included in the articles for the following bid items:

- Item SPV.0105.02, Rest Area 31 Building General Construction
- Item SPV.0105.05, Rest Area 31 Building Electrical

B (Vacant)**C Construction**

Provide shop drawings which specify material sizes, shapes, plan sections, install details and finishes per plans.

D Measurement

The department will measure the Gabion Column Interpretive Sign by each unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.25	Gabion Column Interpretive Sign	Each

Payment is full compensation for furnishing and installing all materials; and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

54. Gabion Column Fence, Item SPV.0060.26.

A Description

This bid item includes all work that is required for constructing the gabion column posts and intermediate fencing, unless some work is specifically covered under other bid items. This work includes the general construction and electrical systems required to complete these gabion column posts and intermediate fencing according to the applicable plans, the “General Requirements for Building Construction”, and the technical specifications included in the articles for the following bid items:

- Item SPV.0105.02, Rest Area 31 Building General Construction
- Item SPV.0105.05, Rest Area 31 Building Electrical

B (Vacant)

C Construction

Provide shop drawings which specify material sizes, shapes, plan sections, install details and finishes per plans.

D Measurement

The department will measure the Gabion Column Fence by each unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.26	Gabion Column Fence	Each

Payment is full compensation for furnishing and installing all materials; and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

55. Karl Foerster Feather Reed Grass 4-inch Pot, Item SPV.0060.27; Stella D’Oro Daylilly 4-inch Pot, Item SPV.0060.28; Flame Grass 4-inch Pot, Item SPV.0060.29; Walker’s Low Catmint 4-inch Pot, Item SPV.0060.30; Emerald Pink Creeping Phlox 4-inch Pot, Item SPV.0060.31; Northwind Switch Grass 4-inch Pot, Item SPV.0060.32; Prairie Drop Seed 4-inch Pot, Item SPV.0060.33.

A Description

Furnish and install perennials/grasses of the specified size according to the pertinent requirements of standard spec 632, the details on the plans, as specified in these special provisions, and as hereinafter provided.

B Materials

Furnish perennials/grasses as standard 4-inch container grown plants.

C (Vacant)**D Measurement**

The department will measure perennials/grasses by the unit for each 4-inch container-grown plant, acceptably furnished and planted.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.27	Karl Foerster Feather Reed Grass 4-inch Pot	Each
SPV.0060.28	Stella D'Oro Daylilly 4-inch Pot	Each
SPV.0060.29	Flame Grass 4-inch Pot	Each
SPV.0060.30	Walker's Low Catmint 4-inch Pot	Each
SPV.0060.31	Emerald Pink Creeping Phlox 4-inch Pot	Each
SPV.0060.32	Northwind Switch Grass 4-inch Pot	Each
SPV.0060.33	Prairie Drop Seed 4-inch Pot	Each

Payment is full compensation for furnishing all plant materials; preparing the planting area and planting perennials/grasses; and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

56. Sanitary Sewer Cleanout 6-Inch, Item SPV.0060.34.**A Description**

Furnish and install the sanitary sewer cleanout, 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 be in compliance with section 63.B.2 of these special provisions.

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 Cleanout 6-inch by each 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.0060.34	Sanitary Sewer Cleanout 6-Inch	Each

Payment is full compensation for excavating, backfilling, and compacting; for furnishing and placing all materials, including fittings 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.

57. Floodlight Lighting Fixture, Item SPV.0060.35.

A Description

Furnish and install bases and fixtures for floodlight fixtures at the locations shown on the plans and according to standard spec 659, the plans, and as hereinafter provided.

B Materials

Furnish product specified on electrical site plans, fixture type LED-F. See lighting specification section 265100 of Building Specifications for further requirements.

C Construction

Floodlight lighting fixture shall be located such that the fixture does not provide a trip hazard. Install and aim fixture after flag poles and sign have been installed.

Floodlight lighting fixture shall be mounted to manufacturer tenon mount accessory.

Aiming shall be approved in writing by owner prior to substantial completion.

Follow all manufacturer's recommendations. See lighting specification section 265100 of Building Specifications for further requirements.

D Measurement

The department will measure Floodlight Lighting Fixtures by each unit, acceptably completed in place.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.35	Floodlight Lighting Fixture	Each

Payment is full compensation for furnishing and installing all materials' furnishing and installing fixture; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work

58. Flexible Lighting Fixture, Item SPV.0060.36.**A Description**

Furnish and install mounting clips, fixtures, drivers, and all manufacturer recommended mounting accessories for flexible lighting fixture at the locations shown on the plans and according to standard spec 659, the plans, and as hereinafter provided.

B Materials

Furnish product specified on electrical site plans, fixture type LED-J. See lighting specification section 265100 of Building Specifications for further requirements.

C Construction

Flexible lighting fixture shall be surface-mounted via mounting clips beneath precast concrete wall cap. Mounting clips shall be spaced per manufacturer's recommendations. Fixture shall powered via hardwire connection to remote power supply located within manufacturer's recommended distance surface mounted to the back of the structure of the planter wall. Each power supply shall be connected as required by manufacturer's recommendations and specifications. Provide quantity of power supplies to match manufacturer's requirements. Provide NEMA 3R enclosure of appropriate size and quantity to meet manufacturer's requirements to house power supply. Coordinate installation and exact location of fixture, driver, and conduit with general contractor prior to construction of wall.

Follow all manufacturer's recommendations. See lighting specification section 265100 of Building Specifications for further requirements.

D Measurement

The department will measure Flexible Lighting Fixture by each 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.0060.36	Flexible Lighting Fixture	Each

Payment is full compensation for furnishing and installing all materials' furnishing and installing fixture; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

59. Floodlight Landscape Lighting Fixture, Item SPV.0060.37.

A Description

Furnish and install bases and fixtures for walkway lighting at the locations shown on the plans and according to standard spec 659, the plans, and as hereinafter provided.

B Materials

Furnish product specified on electrical site plans, fixture type LED-K. See lighting specification section 265100 of Building Specifications for further requirements.

C Construction

Floodlight landscape lighting fixture shall be located such that the fixture does not provide a trip hazard. Coordinate installation and exact location of fixture and conduit with general contractor prior to construction of wall.

Aiming shall be approved in writing by owner prior to substantial completion.

Follow all manufacturer's recommendations. See lighting specification section 265100 of Building Specifications for further requirements.

D Measurement

The department will measure Floodlight Landscape Lighting Fixtures by each 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.0060.37	Floodlight Landscape Lighting Fixtures	Each

Payment is full compensation for furnishing and installing all materials' furnishing and installing fixture; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

60. Fence Chain Link Slatted 8-FT, Item SPV.0090.01.

A Description

Furnish and erect wood or metal-slatted chainlink fence according to standard spec 616, as shown on the plans, and as hereinafter amended.

B Materials

B.1 Fence Fabric

Delete standard spec 616.2.2.1 and replace with the following:

Zinc-coated steel fence fabric shall be woven of No. 9. gauge wire in two-inch diamond pattern mesh when slats are inserted diagonally, and 3-1/2 inch by 5-inch diamond pattern mesh when slats are inserted vertically; have both selvages knuckled; and shall conform to the pertinent requirements for Zinc-Coated Steel Fabric of the Specifications for Chain Link Fence, AASHTO Designation: M 181. The zinc coating, when subjected to the Preece Test (ASTM Designation: A 239 or AASHTO Designation: T 66) shall withstand a minimum of six one-minute dips.

Aluminum-coated steel fence fabric shall be woven of No. 9-gauge wire in 2-inch diamond pattern mesh when slats are inserted diagonally, and 3-1/2 inch by 5-inch diamond pattern mesh when the slats are inserted vertically; have both selvages knuckled; and shall conform to the pertinent requirements for Aluminum-coated Steel Fabric of the Specifications for Chain-Link Fence: AASHTO Designation: M 181.

B.2 Slats

B.2.1 Metal

Metal slats shall be .020-inch minimum thickness galvanized steel or 30-gauge aluminum strips. Metal strips may be inserted diagonally or vertically into the chain-link fabric, shall be woven through the fabric, and securely fastened to it with approved fasteners. Metal slats shall be factory painted, dark green in color, and shall be uniformly colored. Bent, dented, scratched, or missing slats shall be replaced.

B.2.2 General

All slatted fence fabric furnished under the contract shall be of the same type. The slatted fence fabric furnished shall be of the same nominal height as the designated height of the fence.

B.3 Smooth Wire

Amend standard spec 616.2.2.3 as follows:

The tension wire shall be 7-gauge.

C Construction

C.1 Setting Posts

The second sentence of the second paragraph of standard spec 616.3.3.2 is revised to read as follows:

Posts shall be spaced, center to center, at not more than 8 feet when placed on tangent or on a curve with a radius greater than 2000-feet; and not more than 6 feet when placed on a curve with a radius between 200-feet and 1000-feet; and at not more than 5 feet when placed on a curve with a radius of less than 100-feet.

C.2 Erecting Fabric

The fourth sentence of the third paragraph of standard spec 616.3.3.3 is revised to read as follows:

Fabric fasteners shall be placed on line posts, top rail, and braces at not greater than 8-inch centers, and on bottom tension wire at not greater than 12-inch centers.

D Measurement

The department will measure Slatted Chain-Link Fence, 8-FT, completed and accepted in place, by the linear foot. The quantity to be paid shall be the total number of linear feet of fence, measured, center-to-center of end posts, along the top rail, with deductions for gate or other openings.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.01	Slatted Chain-Link Fence, 8-FT	LF

Payment is full compensation for furnishing all materials; for erecting fence, including all hauling, clearing, excavation, placing concrete footings, setting posts, placing braces, and fittings, attaching wire fabric and inserting slats; for removal and disposal of all debris, and excess excavation; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

61. Sanitary Sewer PVC, 6-Inch, Item SPV.0090.02; 8-Inch, Item SPV.0090.03.

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

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.0090.02	Sanitary Sewer PVC, 6-Inch	LF
SPV.0090.03	Sanitary Sewer PVC, 8-Inch	LF

Payment is full compensation for excavating, backfilling, and compacting; for furnishing and placing all materials, including fittings 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.

62. Underground Copper Water Line, 2-Inch, Item SPV.0090.04.

A Description

Furnish and install 2-inch copper water line 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 as required to install the copper waterline to the minimum depth (7.5 feet) indicated on the plans.

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, 2-inch by the linear foot 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 item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.04	Underground Copper Water Line, 2-Inch	LF

Payment is full compensation for furnishing and installing the water pipe; for excavation, backfill and properly disposing of surplus materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

63. 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 bench mark 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 bench marks 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 storm 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; and for furnishing all labor, tools, stakes, flags, pins, lath, equipment and incidentals necessary to complete the work.

64. Underground Copper Water Line, 1-Inch, Item SPV.0090.06.

A Description

Furnish and install 1-inch copper water line from within 5 feet of the rest area building and within 5 feet of the maintenance building, 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 as required to install the copper waterline to the minimum depth (7.5 feet) indicated on the plans.

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, 1-inch by the linear foot acceptably complete in place, 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 item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.06	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; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

65. Steel Landscape Edging ¼-Inch x 6-Inch Black, Item SPV.0090.07.

A Description

Furnish and install ¼-inch x 6-inch black steel landscape edging at the locations shown on the plans.

B Materials

Furnish the following: ¼-inch x 6-inch black steel landscape edging

C Construction

Install steel landscape edging as indicated on the plans or as directed by the engineer.

D Measurement

The department will measure Steel Landscape Edging ¼-Inch x 6-Inch Black by the linear foot of edging, acceptably installed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.07	Steel Landscape Edging ¼-Inch x 6-Inch Black	LF

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

66. Concrete Curb and Gutter, 36-Inch, Type A, Special, Item SPV.0090.08.

Construct Concrete Curb and Gutter, 36-Inch, Type A, Special according to the pertinent requirements of standard spec 601, and the plan details.

67. Stainless Steel Handrail, Item SPV.0090.09.**A Description**

Furnish and install new stainless steel handrail as shown on the plans and as hereinafter provided.

B Materials

Provide metal free from pitting, seam marks, roller marks, grinding marks and stains at areas exposed to view on completed rail units.

Stainless steel pipe and tubing: ASTM A269 Type 304 or Type 316

Finishes: #4 (180 grit) centerless ground

C Construction

Provide shop drawings which specify material sizes, shapes, plans, sections, install details and finishes per requirements.

Fabricate handrails according to approved shop drawings and field dimensions using mitered and welded joints with bends where indicated on shop drawings.

Shop fabricate in greatest possible lengths to eliminate field splicing, but not to exceed 20'-0" in length.

Spiral wrap each section of handrail with heavy Kraft paper or other suitable wrapping, and burlap covering, wood-strip, and steel-band prior to shipment.

Deliver handrail and accessories completely identified for installation procedure. Handle and store handrail to prevent damage or soiling.

Install handrail as shown on the plans. Grind and or dress exposed welds smooth and flush to corner or fillet without weakening rail connection.

Remove all burrs and sharp edges from exposed ends of final rail assemblies.

D Measurement

The department will measure Stainless Steel Handrail per linear foot, acceptably complete 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.0090.09	Stainless Steel Handrail	LF

Payment is full compensation for furnishing all materials; for installation; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

68. Cable In Duct 3-1/0 AWG, Item SPV0090.10; Electrical Wire Power 6 AWG, Item SPV0090.11.

A Description

Furnish and install the required conductors as cable through the conduit, as shown on the plans and hereinafter provided.

B Materials

Furnish the same cable as specified for cable-in-duct in standard spec 655, with the wiring types and quantities to match what is called out for in the plans and specifications.

Where multiple lighting circuits share the same conduit, they may share ground wires.

C Construction

Install according to the applicable specifications for cable-in-duct in standard spec 655, and the plans.

D Measurement

The department will measure Cable In Duct 3-1/0 AWG and Electrical Wire Power 6 AWG, complete in place and accepted, in length by the linear foot, from terminal connection to terminal connection along the centerline of the conduit, with the terminal connection being the centerline of a junction box or at other terminal locations as required by the plans or specifications. Lengths of wire necessary to connect to fixtures, distribution panels, through light poles and within pull boxes shall be considered incidental and shall not be paid separately.

Additional lengths of cable for making the necessary splices and connections at lighting units, junction boxes, distribution centers, and other terminal locations shall be installed by

the contractor and considered as part of the work included in this item, but will not be measured or paid for directly.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV0090.10	Cable In Duct 3-1/0 AWG	LF
SPV0090.11	Electrical Wire Power 6 AWG	LF

Payment is full compensation for furnishing all foundation preparation; for providing all materials including cables; for installing cable in the conduit; for making connections as required and testing installed cable system; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

69. General Requirements for Building Construction.

The following general requirements are applicable to the following bid items:

- Item SPV.0105.01, Rest Area 31 Maintenance Building
- Item SPV.0105.02, Rest Area 31 Building General Construction
- Item SPV.0105.03, Rest Area 31 Building Plumbing
- Item SPV.0105.04, Rest Area 31 Building Heating and Ventilation
- Item SPV.0105.05, Rest Area 31 Building Electrical
- Item SPV.0060.17, Picnic Shelter

Work related to general requirements will not be paid separately, but shall be included in the applicable contract item prices.

INDEX OF GENERAL REQUIREMENT SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

- 011100 Summary of Work
- 013300 Submittal Procedures
- 015100 Temporary Utilities
- 017700 Closeout Procedures

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Work Included in Contract Documents
 - 2. Contract Information

3. Contract Information
4. Contract Information
5. Work Under Other Contracts
6. Future Work
7. Work Sequence
8. Contractor Use of Premises
9. Occupancy Requirements
10. Products Ordered in Advance
11. Owner Furnished Products
12. Work Restrictions

1.02 GENERAL

1.03 WORK UNDER OTHER CONTRACTS

- A. Other Work at Site:
1. Owner reserves the right to let other separate contracts for Work of the Project, or to pursue other Work at the Site with its own personnel.
 2. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
 3. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Work Not Included:
1. Work not included is either marked "NIC," or "by others," on Drawings or is noted in each section of Specifications.
 2. Provide all labor and materials required unless so specifically noted or marked.
 3. Install Work indicated to be furnished by others or owner unless specifically stipulated to be furnished and installed by others or owner.

1.04 CONTRACTOR USE OF PREMISES

- A. Confine operations at Site to areas permitted under contract or as directed by owner.
- B. Conform to site rules and regulations affecting Work while engaged in Project construction.
- C. Construction personnel may park only in areas designated by the owner.
- D. Damaged Property:
1. Patch and/or clean existing improvements and restore damage of property on, or adjacent to Site occasioned by this Work, including, but not limited to, lawns, walks, curbs, pavements, roadways, structures, and utilities which are cut or damaged by operations and are not designated for removal, relocation, or replacement in the course of construction.

2. Public Property or Utilities: Comply with laws, ordinances, rules, regulations, standards, orders of utility owner or any public authority having jurisdiction.
3. Provide written acceptance of restoration work by authority or owner.

1.05 WORK RESTRICTIONS

- A. On-Site Work Hours:
 1. Coordinate working hours with owner.
- B. Existing Utility Interruption:
 1. Do not interrupt utilities serving facilities occupied by owner or others without written permission by owner.
 2. Notify owner 3 days in advance of proposed utility interruptions.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Requirements Included:
 1. Procedures
 2. Shop Drawings
 3. Product Data
 4. Samples
 5. Material Safety Data Sheets

1.02 PROCEDURES

- A. Deliver submittals to architect at address listed in Project Manual with a Transmittal.
- B. Transmit each item under architect-accepted form.
 1. Identify project, contractor, subcontractor, major supplier.
 2. Identify pertinent drawing sheet and detail number, and specification Section number.
 3. Identify deviations from Contract Documents.
 4. Provide space for architect and consultant review stamps.

- C. After architect review of submittal, revise and resubmit as required, identifying changes made since previous submittal.
- D. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

1.03 SHOP DRAWINGS

- A. Shop Drawings will not be accepted for review by architect until after they have been checked and approved by the contractor as evidenced by his approval stamp and signature.
- B. Submit the number of opaque reproductions contractor requires, plus 2 copies that will be retained by architect, plus copies to be included by contractor in O&M Manuals. Contractor's option to provide shop drawings electronically for architects review. Paper copies must be provided for O&M Manuals.
- C. Submit showing system fabrication, installation drawings including plans, elevations, section details of components, and configuration between system and adjoining systems.

1.04 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, testing compliance, warranty, and other data; supplement manufacturers' standard data to provide information unique to the Work.
- B. Submit the number of copies which contractor requires plus 2 copies that will be retained by architect, plus copies to be included by contractor in O&M Manuals. Contractor's option to provide shop drawings electronically for architects review. Paper copies must be provided for O&M Manuals.
- C. Submit manufacturer's printed instructions for delivery, storage, assembly, installation start-up, adjusting, finishing, and maintenance.

1.05 SAMPLES

- A. Submit full range of manufacturer's standard colors, textures, and patterns for architect's selection.
- B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing Work.
- C. Include identification on each sample, giving full information.
- D. Submit the number specified in respective specification section; 1 will be retained by architect. Reviewed samples that may be used in the Work are indicated in the technical sections.

- E. Field Samples:
 - 1. Provide field samples of finishes as required by individual technical section.
 - 2. Install sample complete and finished.
 - 3. Acceptable samples in place may be retained in completed Work.

1.06 MATERIAL SAFETY DATA SHEETS

- A. Submit MSDS to the Site on all products with chemical emissions and as called for in individual technical sections.

1.07 PERMITS FOR APPROVAL

- A. Submit one copy of permits, code inspections, and agency approval documents.

1.08 OPERATIONS AND MAINTENANCE MANUALS

- A. Submit O&M Manuals as called for in section 01 77 00.

1.09 RECORD DRAWINGS

- A. Keep current set of documents as the job site that are marked to show all changes made during construction. Dimensions underground and concealed work and utilities from permanent reference point; record vertical distances. Submit record documents upon completion.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

SECTION 01 51 00 - TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SUMMARY

- A. Temporary utility services and facilities including, but not limited to:
 - 1. Construction water.
 - 2. Electric power service.
 - 3. Lighting.
 - 4. Telephone services.
 - 5. Heat.
 - 6. Sanitary facilities.

7. Site Security.
8. Temporary fire protection.
9. Temporary enclosures.

1.02 QUALITY ASSURANCE

- A. Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary utilities and related services.
- B. Comply with requirements of NECA NJG-6, NFPA 241, ANSI A10, AWWA C651 Series Standards.
- C. Comply with applicable NEMA, NECA, and UL standards and governing regulations for materials and layout of temporary electric service.
- D. Where local laws and regulations conflict with the requirements of NEMA, NFPA, ANSI, AWWA, or NECA, comply with the most stringent requirements.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Provide all required materials and equipment for temporary utilities, services, and facilities.

2.02 UTILITIES

- A. Where local utility company provides only a portion of temporary utility, provide remainder with matching, compatible materials and equipment. Comply with utility company's recommendations and requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide each temporary service and facility ready for use at each location when service or facility is first needed.
- B. Locate temporary utilities where they will serve Project and result in minimum interference with performance of the Work.
- C. Maintain, relocate, modify, and extend utilities as required during course of Work.
- D. Use qualified tradepersons for installation of temporary utilities.

3.02 CONSTRUCTION WATER

- A. Contractor shall provide and pay for water used for construction purposes.
- B. Secure water necessary for construction and testing and pay service connection charges.
- C. Install water service and distribution piping of sizes and pressures adequate for construction purposes.
- D. Where available supply of potable water is inadequate, provide non-potable water for purposes other than drinking and washing.
- E. Where non-potable water is used, provide warning signs on the discharge end of each length of hose and at the shut-off nozzles.
- F. Where shut-off nozzles are used at water hose discharge, provide heavy-duty abrasion-resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system.
- G. Trades needing a larger source of water are responsible for the source and distribution.
- H. Exercise control over usage to conserve water.
- I. Sterilize temporary water piping for potable water prior to use.
- J. Maintain distribution system to avoid damage to existing or new construction.
- K. Avoid damage to permanent plumbing at source of temporary water.

3.03 ELECTRIC POWER SERVICE

- A. Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of Work.
- B. Contractor shall provide and pay for electricity used for construction purposes.
 - 1. Electrical service shall be provided and installed by contractor.
 - 2. Any Trade requiring power with different characteristics than provided shall arrange and pay for access to such power.
- C. When permanent power and lighting systems are in operation, they may be used for construction purposes.
- D. Whenever an overhead floor or roof deck has been installed, install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in area of Work.

- E. Install service and grounding in compliance with NFPA 70. Include necessary meters, transformers, overload protected disconnect, and main distribution switch gear.
- F. Connect temporary service to local electric power company main as directed by electric company officials.
- G. Install temporary service with an automatic ground-fault interrupter feature, activated from circuits of the system.
- H. Install circuits of adequate size and proper characteristics for each use.
 - 1. Run wiring overhead and rise vertically where wiring will be least exposed to damage from construction operations.
 - 2. Install rigid steel conduit or equivalent raceways for wiring that must be exposed on grade, floors, decks, or other areas of possible damage or abuse.
- I. Provide identification/warning signs at power outlets that are other than 110 to 120 volt power.
- J. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110 to 120 volt plugs into higher voltage outlets.
- K. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.
- L. Use only grounded extension cords.
 - 1. Use "hard-service" cords where exposed to abrasion and traffic.
 - 2. Use single lengths or waterproof connectors to connect separate lengths of electric cords.

3.04 LIGHTING

- A. Install local switching of temporary lighting, spaced to allow lighting to be turned off in patterns to conserve energy and retain light suitable for work-in-progress, access traffic, security check, and Project lock-up.
- B. Provide not less than one 200-watt incandescent lamp per 1,000 square feet of floor area, uniformly distributed, for general construction lighting, or equivalent illumination of a similar nature.
 - 1. In corridors and similar traffic areas, provide not less than one 100 watt incandescent lamp every 50 feet.
 - 2. In stairways and at ladder runs, locate not less than one 100 watt incandescent lamp for illuminating each landing and flight.
- C. Install and operate temporary lighting that will fulfill security and protection requirements, without the necessity of operating entire temporary lighting system.

- D. Provide general service incandescent lamps of wattage required for adequate illumination.
- E. Protect lamps with guard cages or tempered glass enclosures.

3.05 TELEPHONE SERVICES

- A. Contractor shall maintain and pay for telephone on Site for use.

3.06 HEAT

- A. Temporary heating, ventilation and enclosures required by Work under Contract shall be provided and paid by contractor requiring same.
- B. Provide temporary heat for performance of the Work, curing or drying of recently installed work, or protection of work-in-place from adverse effects of elements.
- C. Provide temporary heating units, tested and labeled by UL, FM, or other recognized trade association related to the fuel being consumed.
- D. Select units known to be safe and without deleterious effect upon work-in-place or being installed.
 - 1. Except where conditions make it necessary to use another system, and where use of the permanent heating system is available and authorized by architect, provide properly vented self-contained liquid propane gas or fuel oil heaters with individual space thermostatic controls for temporary heat.
- E. Coordinate ventilation requirements to produce indicated ambient condition required, to prevent accumulations of dust, fumes, vapors or gases, and to minimize consumption of fuel or energy.
- F. Extend and supplement with temporary units as required to maintain specified conditions for construction operations, and to protect materials and finishes from damage due to temperature or humidity.
- G. After Enclosure:
 - 1. Owner will not allow use of permanent heating system for temporary heat.
- H. Maintain a minimum temperature of 50 degrees in permanently enclosed portions of the structures and areas where finished Work has been installed.

3.07 SANITARY FACILITIES

- A. Provided by contractor for workers engaged in this Work. (Construction personnel may not use sanitary facilities within existing building.)

3.08 SITE SECURITY

- A. Coordinate activities with owner to ensure a secure site during the project. Provide security measures as required throughout work.

3.09 TEMPORARY FIRE PROTECTION

- A. Provided portable fire extinguishers or water hoses at the ready throughout the site during the course of the entire project. Extinguishers shall be non-freeze, dry chemical ABC, NFPA approved units.

3.10 TEMPORARY ENCLOSURE

- A. Provide temporary enclosures to maintain the building in weather tight condition and to secure doors, windows and openings.

3.11 TERMINATION, AND REMOVAL

- A. At Substantial Completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during construction, including but not limited to:
 - 1. Replace air filters and clean inside of ductwork and housings.
 - 2. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
 - 3. Replace lighting system lamps that are burned out or noticeably dimmed.

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Administrative and procedural requirements for contract closeout, including:
 - 1. Submittals.
 - 2. Inspection procedures.
 - 3. Warranties.
 - 4. Record document submittals.
 - 5. Final cleaning.
- B. Related Sections:
 - 1. Specific requirements for individual units of work are included in appropriate technical sections

1.02 SUBSTANTIAL COMPLETION

- A. Complete the following before requesting Architect's inspection for certification of Substantial Completion for each phase of work. List items that are incomplete in request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Obtain, submit releases enabling owner unrestricted use of the Work and access to services and utilities.
- B. Inspection Procedures:
1. When prerequisites are complete, submit request in writing to Architect stating that all requirements are satisfied, and requesting inspection.
 2. Upon receipt of contractor's request for inspection, Architect will either proceed with inspection or advise contractor of unfilled prerequisites.
 3. Following initial inspection, Architect will either prepare Certificate of Substantial Completion, or advise contractor of work which must be performed before certificate will be issued. Architect will repeat inspection when requested and when assured that work has been substantially completed.
 4. Results of completed inspection will form the basis of requirements for Final Acceptance.

1.03 FINAL ACCEPTANCE

1. Warranties: Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications, similar documents to the owner.
2. Signed receipt by owner for delivery of keys for doors, special tools for operations and maintenance and other specified products.
3. Maintenance:
 - a. Materials: Provide signed receipt by owner for delivery of attic stock maintenance materials as called for in specifications.
 - b. Maintenance instructions for equipment.
 - c. Maintenance manuals:
 - 1) Organize operating, maintenance data into suitable sets of manageable size.
 - 2) Bind into individual heavy-duty 2-inch, 3-ring vinyl-covered binders with pocket folders, each set of data, marked with appropriate identification on both front and spine of each binder.
 - 3) Include:
 - a) Emergency instructions.
 - b) Spare parts listing.
 - c) Copies of warranties.

- d) Wiring diagrams.
 - e) Recommended “turnaround” cycles.
 - f) Inspection procedures.
 - g) Shop Drawings and Product Data.
 - 4. Miscellaneous Record Submittals:
 - a. Refer to other sections of specifications for requirements of miscellaneous record keeping and submittals in connection with actual performance of work.
 - b. Complete miscellaneous records, place in good order, properly identified and bound or filed, ready for continued use and reference.
 - 5. Records:
 - a. Test/adjust/balance records.
 - b. Startup performance reports.
- B. Record Drawings: Submit to owner a set of record prints marked to show “as-built” conditions for work of contract.

1.04 OPERATING AND MAINTENANC INSTRUCTIONS/DEMONSTRATIONS

- A. Arrange for each installer of operating equipment and other work requiring regular or continuing maintenance, to meet at Site with owner’s personnel to provide necessary basic instruction in proper operation and maintenance of entire work. Where installers are not experienced in required procedures, include instruction by manufacturer’s representatives.
- B. Provide detailed review of following items:
 - 1. Maintenance manuals.
 - 2. Record documents.
 - 3. Spare parts and materials.
 - 4. Tools.
 - 5. Lubricants.
 - 6. Fuels.
 - 7. Identification systems.
 - 8. Control sequences.
 - 9. Hazards.
 - 10. Cleaning materials and procedures.
 - 11. Warranties, bonds, maintenance agreements similar continuing commitments.
- C. As part of this instruction for operating equipment, demonstrate following procedures:
 - 1. Start-up.
 - 2. Shut-down.
 - 3. Emergency operations.
 - 4. Noise and vibration adjustments.
 - 5. Safety procedures.
 - 6. Economy and efficiency adjustments.
 - 7. Effective energy utilization.

PART 2 PRODUCTS

2.01 CLEANING AGENTS

- A. Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned.
- B. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 EXECUTION

3.01 FINAL CLEANING

- A. Provide final cleaning, following manufacturer's written instructions.
- B. Conduct cleaning and waste-removal operations to comply with local laws and ordinances, and federal and local environmental and antipollution regulations.
- C. Employ experienced workers or professional cleaners for final cleaning.
- D. Comply with safety standards for cleaning.
 - 1. Do not burn waste materials.
 - 2. Do not bury debris or excess materials on owner's property.
 - 3. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
 - 4. Remove waste materials from Site and dispose of lawfully.
- E. Clean Site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
- F. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program.
 - 1. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - 2. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - 3. Remove tools, construction equipment, machinery, and surplus material from Site.
 - 4. Remove snow and ice to provide safe access to building.
 - 5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - 6. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - 7. Sweep concrete floors broom clean in unoccupied spaces.

8. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
9. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
10. Remove labels that are not permanent.
11. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
12. Replace parts subject to unusual operating conditions.
13. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
14. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
15. Clean ducts, blowers, and coils if units were operated without filters during construction.

Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

70. Rest Area 31 Maintenance Building, Item SPV.0105.01.

A Description

This item consists of all work required for the construction of the two new maintenance buildings unless specifically covered under other bid items. This work includes the general construction, plumbing, mechanical, and electrical systems required to complete these buildings according to the applicable plans, the 'General Requirements for Building Construction', and the technical specifications included the articles for the following bid items:

- Item SPV.0105.02, Rest Area 31 Building General Construction
- Item SPV.0105.03, Rest Area 31 Building Plumbing
- Item SPV.0105.04, Rest Area 31 Building Heating and Ventilation
- Item SPV.0105.05, Rest Area 31 Building Electrical

This bid item does not include fencing, concrete driveway 6-inch, or other general construction items outside the exterior walls of the maintenance buildings, except as specifically noted. Pipe bollards adjacent to the building are included in item. Work outside the exterior perimeter of the maintenance buildings is to be measured and paid for under other applicable bid items.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Rest Area (No.) Maintenance Building as a single complete lump sum unit of work, complete in place and accepted.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.01	Rest Area 31 Maintenance Building	LS

Payment is full compensation for furnishing all materials and equipment; and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

71. Rest Area 31 Building General Construction, Item SPV.0105.02.**A Description**

This work includes the general construction required to complete the rest area buildings according to the applicable plans, the 'General Requirements for Building Construction', and the technical specifications.

B (Vacant)**C (Vacant)****D Measurement**

The department will measure Rest Area (No.) Building General Construction as a single lump sum unit, complete in place and accepted.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.02	Rest Area 31 Building General Construction	LS

Payment is full compensation for furnishing all materials and equipment, and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

INDEX OF GENERAL CONSTRUCTION SPECIFICATIONS

03 11 00 Concrete Forming
 03 20 00 Concrete Reinforcing
 03 30 00 Cast-In-Place Concrete
 03 45 00 Precast Architectural Concrete
 04 20 00 Unit Masonry Assemblies
 04 43 00 Stone Masonry
 05 12 00 Structural Steel Framing
 05 50 00 Metal Fabrications
 06 10 00 Rough Carpentry

06 17 53 Shop-Fabricated Wood Trusses
06 82 00 Glass-Fiber-Reinforced Plastic Panels
07 11 13 Bituminous Dampproofing
07 21 00 Thermal Insulation
07 21 29 Sprayed Insulation
07 22 16 Roof Board Insulation
07 27 00 Air Barriers
07 41 13 Metal Roofing and Wall Panels
07 46 33 Plastic Siding
07 46 46 Mineral-Fiber Cement Siding
07 53 23 EPDM Membrane Roofing
07 62 00 Sheet Metal Flashing and Trim
07 84 00 Firestopping
07 92 00 Joint Sealants
08 11 13 Hollow Metal Doors and Frames (Commercial)
08 33 00 Coiling Doors and Grilles
08 36 13 Sectional Steel Overhead Doors
08 43 13 Aluminum-Framed Storefront
08 80 00 Glazing
08 90 00 Louvers and Vents
09 29 00 Gypsum Board
09 51 13 Acoustical Panel Ceilings
09 65 19 Resilient Tile Flooring and Base
09 67 00 Fluid Applied Flooring
09 91 00 Painting
10 14 23 Panel Signage
10 21 20 Reinforced Composite Toilet Compartments
10 28 13 Toilet Accessories
10 44 00 Safety Specialties
10 51 13 Metal Lockers
12 48 16 Floor Grilles
12 75 50 Interior Benches

DIVISION 3 - CONCRETE

SECTION 03 11 00 - CONCRETE FORMING

PART 1 GENERAL

1.01 SUMMARY

- A. Design and installation of formwork with shoring, bracing and anchorage for cast-in-place concrete.

1.02 REFERENCES

- A. ACI 347 - Recommended Practice for Concrete Formwork

1.03 SUBMITTALS

- A. Submit Product Data for form ties.

1.04 QUALITY ASSURANCE

- A. The design, engineering, and proper construction of all formwork shall be the responsibility of the contractor.
- B. Design formwork according to ACI 347.

1.05 PRODUCT HANDLING

- A. Do not store forms or equipment on finished slabs.

PART 2 PRODUCTS

2.01 FORM MATERIAL

- A. Form Facing Material: Smooth faced, undamaged plywood or other panel type material approved by Engineer.
- B. The form facing material shall produce a smooth, hard, uniform texture on the concrete.
- C. The arrangement of the facing material shall be orderly and symmetrical with the number of seams kept to a minimum.
- D. Do not use facing material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface.
- E. Fiber Tube Forms: Continuous laminated fiber tube with exterior moisture protection and non-adhering interior surface similar to "A Coated Sonotube" as manufactured by Sonoco Products, Quickrete, or approved equal.
- F. Void Forms:
 - 1. Corrugated fiberboard forms impregnated with paraffin, as manufactured by firm regularly engaged in production of corrugated fiberboard forms.
 - 2. Design to safely support dead load of concrete and construction live loads for period of 2 weeks.
 - 3. Design to prevent leakage of concrete or backfill materials and treat to prevent loss of strength and softening of form material due to moisture absorption.

2.02 FORM TIES

- A. Form Ties: Factory fabricated, adjustable length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
- B. The portion of the tie remaining in the concrete after removal of the tie shall be at least 1 inch from the surface of the concrete.
- C. Provide waterseals on all wall ties used in water containment structures and exterior walls.

2.03 FORM COATINGS

- A. Form Coatings or Release Agents: Commercially formulated chemical release agents containing no lubrication oil, conventional form oil, fuel oil, or kerosene. Containers shall have manufacturer's instructions for use printed thereon.
- B. The form coating shall not penetrate, stain, or leave a residual film on the concrete surface and shall not attract dirt or other deleterious material.

2.04 ACCESSORIES

- A. Chamfer Strips: 3/4 inch by 3/4 inch wood or plastic strips.
- B. Provide all anchorages, braces, and special forms required to construct cast-in-place concrete components shown on the Drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. Establish a benchmark in an accessible location and use as a reference point for various construction levels.
- B. Verify lines, levels, and centers before proceeding with formwork.
- C. Ensure that dimensions agree with the Drawings. Report any discrepancies to Engineer before proceeding with Work.

3.02 FORMWORK DESIGN

- A. The design and construction of the formwork shall be the responsibility of the contractor.
- B. Design formwork according to ACI 347.
- C. Formwork shall be designed, erected, supported, braced, and maintained to safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure.

- D. Camber formwork to compensate for anticipated deflections in the formwork prior to hardening of the concrete.
- E. Provide positive means of adjustment of shores and struts.
 - 1. Take up all settlement during concrete placing operations.
 - 2. Securely brace forms against lateral deflections.

3.03 FORMWORK CONSTRUCTION

- A. Provide forms for all concrete work. Do not use earth cuts as forms for vertical surfaces.
- B. Construct forms to conform to slopes, lines, and dimensions shown on the Drawings.
- C. Forms shall be sufficiently tight to prevent loss of mortar from the concrete.
- D. Place chamfer strips at all exposed corners.
- E. Install all required openings, frames, pipe sleeves, cavities, slots, and other embedded items.
- F. Cut all holes in forms required for installation or embedment of concrete reinforcement bars and ties.
- G. Provide sharp clean corners at intersecting planes without visible edges or offsets. Back joints with extra studs or girts to maintain true, square corners.
- H. Provide temporary openings at the base of column forms and wall forms to facilitate cleaning and observation immediately before concrete is placed.
 - 1. Construct closures to ensure a tight fit flush with the adjoining surfaces.
- I. Provide runways for moving equipment.
 - 1. Provide runways with struts or legs and support directly on the formwork.
 - 2. Runways shall not rest on the reinforcing steel.
- J. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris before concrete is placed.
- K. Install Void Forms:
 - 1. Protect from moisture before concrete placement. Store above ground level in dry location.
 - 2. Do not use forms subjected to water, moist soils, or damp storage unless test loaded.
 - 3. Install on surface providing uniform support. Conform to recommendations of manufacturer.
 - 4. Protect from crushing and penetration of form at reinforcing steel supports and at other supports.

3.04 TOLERANCES

- A. Construct formwork so that concrete surfaces will conform with the following tolerances:
1. Variation from Plumb:
 - a. In any 10 feet of length: 1/4 inch.
 - b. Maximum for entire length: 1/2 inch.
 2. Variation from the Level or Specified Grade:
 - a. In any 10 feet of length: 1/4 inch.
 - b. Maximum for entire length: 1/2 inch.
 3. Variation of the Linear Building Lines from Established Position in Plan and Related Position of Columns, Walls, Grade Beams and Partitions:
 - a. In any 20 feet of length: 1/2-inch.
 - b. Maximum for entire length: 1 inch.
 4. Variation in the Sizes and Locations of Sleeves, Floor Openings, and Wall Openings: 1/4-inch plus or minus.
 5. Variation in Cross-sectional Dimensions of Columns and Beams and in the Thickness of Slabs and Walls:
 - a. Minus: 1/4-inch.
 - b. Plus: 1/2-inch.
 6. Footings (tolerances apply to concrete dimensions only, not to positioning of reinforcing steel):
 - a. Variations in dimensions in plan:
 - 1) Minus: 1/2-inch.
 - 2) Plus: 1 inch.
 - b. Misplacement: 1 inch.
 - c. Thickness:
 - 1) Decrease in thickness: 1/2-inch.
 - 2) Increase in thickness: No limit

3.05 FORM SURFACE PREPARATION

- A. Clean surfaces of forms and embedded material of all accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.
- B. Before placing the reinforcing steel or the concrete, cover the surfaces of the forms with an acceptable coating material that will effectively prevent absorption of moisture, prevent bond with the concrete, and not stain the concrete surfaces.
- C. Do not allow form coating material to stand in puddles in the forms.
- D. Form coating material shall not come in contact with hardened concrete against which fresh concrete is to be placed.
- E. Spray form coating on all concrete form surfaces, including wood forms for wall openings, keyway strips, and chamfer strips. Apply coatings according to manufacturer's instructions.

3.06 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used.
- B. Do not use split, frayed, delaminated, or otherwise damaged form facing material.

3.07 FORM REMOVAL

- A. Time specified below in this Article represents cumulative time during which temperature of concrete is maintained above 50 degree F (10 degree C) and for concrete without set-controlling admixtures.
 - 1. Reduce removal time in half for high-early strength cement concrete.
- B. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations, but not less than 24 hours after completing concrete placement and finishing.
- C. Forms and shoring used to support the weight of concrete in beams, slabs, and other structural members shall not be removed in less than 10 days and not until the concrete has attained 3,500 psi minimum compressive strength. Determine compressive strength by field-cured specimens.
- D. Once forms and shoring supporting beams, slabs, and other structural members have been removed, reshore concrete structural members at each level the same day such that all superimposed loads are uniformly distributed and transferred directly to the foundation through temporary supports.
 - 1. No construction or other live loads shall be permitted on the members, unless sufficient support is in place or concrete has attained full design strength and loads do not exceed the design maximum, as approved by Engineer.
- E. Contractor shall be responsible for all damage resulting from removal of forms or premature overloading of structural members.

Loosen wood forms for wall openings as soon as possible without damage to the concrete

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnish and install concrete reinforcement.

1.02 REFERENCES

- A. ACI:
 - 1. 117 - Standard Specifications for Tolerances for Concrete Construction and Materials
 - 2. 301 - Specifications for Structural Concrete for Buildings
 - 3. 315 - Details and Detailing of Concrete Reinforcement
- B. CRSI Manual of Standard Practice

1.03 SUBMITTALS

- A. Submit complete Shop Drawings and bar lists of all material to be furnished and installed under this Section.
 - 1. Show bar sizes, spacings, locations, and quantities of reinforcing and bending details.
- B. Provide Shop Drawings according to ACI 315 and the CRSI Manual of Standard Practice.
 - 1. Show in detail the location, size, spacing, bends, and quantities of each and all reinforcing bars to be placed in the structure.
 - 2. Bars shall have unique identifying labels or marks for each size, length, bend configuration, etc.
- C. Submit Product Data on threaded dowel inserts.
- D. Submit mill certifications for concrete reinforcement at time of delivery.
- E. Submit certification for the epoxy coating at the time of delivery.
 - 1. Documentation of certification data shall come directly from the manufacturing plant's quality control office.
 - 2. Certification data shall contain test data and measurements taken at times and locations approved by Engineer.
 - 3. Monitoring shall be done by personnel not directly involved in production and be sufficient for compliance with approved procedures.

1.04 QUALITY COMPLIANCE

- A. Comply with ACI 117, ACI 301, and ACI 315, except as modified in this Section.

1.05 PRODUCT HANDLING

- A. Deliver reinforcement to the Site bundled, tagged, and marked.
 - 1. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement Drawings.
- B. Store reinforcement at the Site in a manner to prevent damage from drainage and accumulation of dirt and excessive rust.

- C. Do not store reinforcement, supports, or equipment on finished slabs.
- D. Store metal bar supports in a weather-proof shelter.
- E. Repair coating damage due to shipping, handling, and placing with an epoxy paint or equivalent coating material approved by Engineer.
 - 1. Damaged areas shall not exceed 2 percent of the surface area per linear foot of each bar.
 - 2. Coating color fading will not be considered coating damage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Bars: Deformed billet steel bars conforming to ASTM A615, Grade 60.
- B. Welded Wire Fabric: Steel wire spot welded at intersections conforming to ASTM A185. Use flat sheets only.
- C. Epoxy-Coated Reinforcing Steel: Conform to ASTM A775.

2.02 ACCESSORIES

- A. Bar Supports for Elevated Slabs, Walls, Columns, and Beams: All bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place shall be plastic protected, conforming to CRSI Class 1 protection for bar supports.
- B. Ground Supported Reinforcing:
 - 1. All supports for ground supported reinforcement shall conform to CRSI Class 1 protection for bar supports.
 - 2. All supports shall be supplied with precast concrete blocks with a minimum bearing surface of 100 sq. inches to prevent the support from sinking.
- C. Tie Wire for Reinforcing Bars: Black annealed wire, 16 gage or heavier.
- D. Tie Wire for Epoxy-Coated Reinforcing Bars: 16 gage or heavier annealed wire epoxy-coated or other polymer approved by Engineer.
- E. Threaded Dowel Inserts: Manufactured of minimum Grade 60 steel and shall be capable of achieving 125 percent of specified yield strength of reinforcement steel for the bar size indicated.
- F. Mechanical Bar Splices:
 - 1. Manufactured of minimum Grade 60 steel.
 - 2. Shall achieve 125 percent of specified yield strength of reinforcement steel for the bar size indicated.

- G. Wire Supports for Epoxy-Coated Reinforcement: Supports shall be coated with dielectric material including epoxy or other polymer for a minimum of 2 inches from the point of contact with epoxy-coated reinforcement.

2.03 FABRICATION

- A. Shop fabricate reinforcing steel to required shapes and dimensions.
- B. Do not rebend or straighten reinforcing steel.
- C. Fabricate bars according to the fabricating tolerances given in ACI 315.

2.04 FINISHES

- A. Epoxy coating shall be applied in a fusion bonded coating plant that has been granted “Certification” by CRSI (Concrete Reinforcing Steel Institute).

PART 3 EXECUTION

3.01 PLACING

- A. Place reinforcing steel according to the Structural Drawings, approved Shop Drawings, and as specified herein.
- B. Reinforcing steel shall have the following concrete cover, unless specifically noted differently on the Drawings:
 - 1. Concrete cast against earth 3 inches.
 - 2. All other concrete 2 inches.
- C. Properly position reinforcing steel and wire it together at intersections and supports to ensure against displacement during concrete placing. Tie all reinforcing steel to wall forms.
- D. Support reinforcing steel for slabs on grade by placing the top of precast concrete blocks, flush with grade, at all locations where chairs are to be located. Place chairs or standees over concrete blocks.
- E. Wire dowels in place before placing concrete.
- F. Place and tie all reinforcing steel before concrete is placed.
- G. Do not bend reinforcing steel embedded in hardened or partially hardened concrete after placing.
- H. Place wall chairs at the top and bottom of all walls and not greater than 6 feet on center horizontally.
- I. All reinforcement at the time concrete is placed shall be free of mud, oil, or other materials that may adversely affect or reduce the bond.

- J. Support the reinforcing steel closest to the formed surface with chairs and bolsters. Support beam stirrups and column ties by chairs.
- K. After completing welds on epoxy-coated reinforcement, repair damaged coating according to the requirements stated in Part 1 of this Section.
- L. Reinforcement used as supports with epoxy-coated reinforcement shall be epoxy coated.
- M. After field bending or straightening epoxy-coated reinforcing bars, repair coating damage according to Part 1 of this Section.

3.02 SPLICES

- A. Provide reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Provide lap splice lengths as shown on the Drawings.
- B. Provide splices only as shown on the Drawings or as authorized by Engineer.
- C. Provide threaded or other approved mechanical bar splices:
 - 1. Where shown on the Drawings.
 - 2. Elsewhere for the convenience of the contractor at no additional cost to owner if specifically requested of and approved by Engineer.

3.03 TOLERANCES

- A. Place bars to the tolerances specified in ACI 117.

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish and install all cast-in-place concrete and accessories.
- B. Related Sections:
 - 1. Section 03 11 00 - Concrete Forming
 - 2. Section 03 20 00 - Concrete Reinforcing
 - 3. Section 03 35 22 – Mechanically Polished Concrete

1.02 REFERENCES

- A. ACI:
 - 1. 301 - Specifications for Structural Concrete for Buildings
 - 2. 305 - Hot Weather Concreting

3. 306 - Cold Weather Concreting
4. 309 - Recommended Practice for Consolidation of Concrete
5. 350 - Environmental Engineering Concrete Structures

B. ASTM:

1. A36 - Carbon Structural Steel
2. A307 - Carbon Steel Bolts and Studs
3. A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
4. C33 - Standard Specification for Concrete Aggregates
5. C94 - Standard Specification for Ready-Mixed Concrete
6. C171 - Standard Specification for Sheet Materials for Curing Concrete
7. C260 - Standard Specification for Air-Entraining Admixtures for Concrete
8. C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
9. C494 - Standard Specification for Chemical Admixtures for Concrete
10. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
11. C979 - Standard Specification for Pigments for Integrally Colored Concrete
12. C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars
13. C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures
14. D1741 - Test Method for Functional Life of Ball Bearing Greases (Withdrawn 1991)

1.03 SUBMITTALS

- A. Submit manufacturer's data for concrete admixtures, liquid curing material, floor joint filler, finishing compounds, bonding agents, and adhesive anchoring material.
- B. Submit concrete aggregate test reports and concrete mix designs at least 14 days prior to placement of concrete.
- C. Samples:
 1. Color Samples: Submit manufacturer's standard color samples for initial selection of Integrally Colored Concrete. Coordinate with section 03 35 22.
- D. Submit results of concrete strength tests.

1.04 QUALITY ASSURANCE

- A. Comply with ACI 301, except as modified in this Section.
- B. Retain an independent testing laboratory approved by Engineer to perform the work listed below. All costs for this testing shall be paid by contractor:
 1. Test proposed aggregate.
 2. Design concrete mixes for each type of concrete specified.

3. Cast concrete cylinders for strength tests.
 4. Test concrete cylinders.
- C. Aggregate Tests: Test aggregates for compliance with ASTM C33.
- D. Concrete Mix Design:
1. Prepare mix designs for each type of concrete specified.
 2. Design concrete mixes according to ACI 301.
- E. Mockups:
1. After initial color selection, erect mock-up for integrally colored and mechanically polished concrete materials. Mockup shall demonstrate aesthetic effects as well as qualities of materials and execution.
 2. Build mock-up to comply with the following requirements, using materials indicated for final unit of Work.
 - a. Location: Locate mock-up on site in location and size indicated or, if not indicated, as directed by architect.
 - b. Scope: Demonstrate the proposed range of aesthetic effects and workmanship.
 - c. Size: Minimum 10-feet by 10-feet.
 - d. Quantity: Provide minimum of 2-mockup samples.
 - e. Coordinate mockup with section 03 35 22.
 - f. Acceptance: Obtain architect's acceptance of mock-up before start of final unit of Work.
 - g. Maintenance: Retain and maintain mock-up during construction in undisturbed condition as a standard for judging completed unit of Work.
 - h. Accepted mock-up in undisturbed condition at time of Substantial Completion may become part of completed unit of Work.
- F. Adjustment to Concrete Mixes: May be requested when characteristics of materials, job conditions, weather, test results, other circumstances warrant, at no additional cost to owner and as accepted by Engineer.

1.05 PRODUCT HANDLING

- A. Do not store forms, shores, reinforcing, equipment, or other material on finished slab surfaces.

PART 2 PRODUCTS

2.01 CONCRETE MATERIAL

- A. Cement: Conform to ASTM C150, Type I.
1. Alkali content less than or equal to 0.6 percent (expressed as Na₂O).
 2. Provide cement from one source of supply.

- B. Aggregate:
1. Coarse Aggregate: ASTM C33-5S
 - a. Provide from 1 source of supply.
 - b. For exterior exposed surfaces.
 2. Fine Aggregate: ASTM C33.
 - a. Provide from 1 source of supply.
 - b. For exterior exposed surfaces.
 3. Do not use fine or coarse aggregates containing spalling-causing deleterious substances.
 4. Local aggregates not complying with ASTM C33 but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when approved by Engineer.
 5. Maximum Size:
 - a. $\frac{1}{5}$ the narrowest dimension of concrete member; nor
 - b. $\frac{1}{3}$ the depth of slab; nor
 - c. $\frac{3}{4}$ the clear spacing between reinforcement bars; nor
 - d. 1-1/2 inches
 6. Gradation sizes 467, 57 or 67: ASTM C33, Table 2.
- C. Water: Clean potable and free from deleterious amounts of oil, acid, alkali, or other foreign matter.

2.02 ADMIXTURES

- A. Air Entraining Admixture: ASTM C260.
- B. Water Reducing Admixture: ASTM C494, Type A.
- C. High Range Water-Reducing Admixtures (Superplasticizer): ASTM C494, Type F and contain no chlorides.
- D. Retarding Admixtures: ASTM C494, Types B and D.
- E. Set-Accelerating Admixtures: ASTM C494, Type C. No chloride containing admixtures will be allowed.
- F. Viscosity Modifying Admixture: Demonstrate compatibility with other admixtures.
- G. Pozzolans:
1. Fly Ash: ASTM C618, Class C or F. Loss on ignition shall be limited to 3 percent maximum.
 2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
 3. Silica Fume: ASTM C1240, 6 percent maximum.
- H. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

- a. ChemMasters.
 - b. Davis Colors.
 - c. Hoover Color Corporation.
 - d. Scofield, L. M. Company.
2. Color: As selected by architect from manufacturer's full range.

2.03 MISCELLANEOUS MATERIAL

- A. Burlap-Polyethylene Sheet: Burlap weighing not less than 10 ounces per linear yard, 40 inches wide impregnated on 1 side with white opaque polyethylene 0.006 inch thick. Sheeting shall conform to ASTM C171.
- B. Liquid Curing Compound: ASTM C309, Type 1, Class B clear or translucent with non-yellowing fugitive dye. Do not apply to floor slabs.
 - 1. At Integrally Colored Concrete floor slabs to be mechanically polished concrete shall be wet cured according to this specification for wet curing methods. Curing compounds may not be utilized. Coordinate with section 03 35 22.
- C. Expansion Joint Material: Bituminous fiber type conforming to ASTM D1751 with bituminous or paraffin binder.
- D. Interior Joint Filler: 1 part, self leveling, polymer reinforced joint filler.
 - 1. Everjoint manufactured by L&M Construction Chemicals, Inc., Euclid Chemical Company, or approved equal.
- E. Exterior Joint Sealant: 2 parts, self leveling, polyurethane sealant.
 - 1. Sonolastic SL2 manufactured by Sonneborn, Euclid Chemical Company, or approved equal.
- F. Bonding Agent: Acryl 60 manufactured by Thoro System Products, Euclid Chemical Company, or approved equal.
- G. Adhesive for anchoring steel reinforcement dowels and threaded rods in concrete: 2 component injected epoxy structural adhesive.
 - 1. Approved Products:
 - a. Hilti RE-500 Adhesive by Hilti Fastening Systems
 - b. Epoxy-Tie Adhesive by Simpson Strong-Tie
 - c. Epogel by Sonneborn
 - d. Approved equal
- H. Vapor Barrier: ASTM E1745, Class A, minimum 10 mils thick polyethylene film, water vapor transmission of 0.00 or perm level of 0.01.
- I. Epoxy Injection: Sika 35, Hi-Mod, LV, Hilti, or equal with Sikadur 31 Paste Epoxy or equal to be installed as manufacturer's recommendations.

2.04 CONCRETE MIX PROPORTIONS

- A. See Table 2.1 at the end of the Section.
- B. Integrally Colored Concrete:
 - 1. Following requirements of Table 2.1 plus the following:
 - a. Cement Color: White.
 - b. Pigment Limit: Pigment shall not exceed 5-percent of cement content.

PART 3 EXECUTION

3.01 CONCRETE PRODUCTION

- A. Ready-mixed concrete: Comply with ASTM C94.
 - 1. Air Temperature between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C): Reduce mixing and delivery time to 75 minutes.
 - 2. Air Temperature above 90 degrees F (32 degrees C): Reduce mixing and delivery time to 60 minutes.
 - 3. Batch Ticket: Provide for each batch discharged and used in work, indicating project identification name and number date, mix type, mix time, quantity and amount of water introduced and available.
- B. Mix concrete only in quantities for immediate use. Concrete which has set shall be discarded and shall not be retempered.
- C. Do not add water at the Site without the approval of Engineer.
- D. Add superplasticizer and mix concrete according to manufacturer's specification.

3.02 EMBEDDED ITEMS

- A. Place all sleeves, inserts, anchors, and embedded items required for adjoining work or for its support prior to placing concrete.
- B. Position all embedded items accurately and supported against displacement.
- C. Temporarily fill voids in sleeves, inserts, and anchor slots with readily removable material to prevent the entry of concrete into the voids.

3.03 PREPARATION BEFORE PLACING

- A. Complete formwork and secure all reinforcement and embedded items in place.
- B. Remove all snow, ice, and mud prior to placing concrete.
- C. Do not place concrete on frozen ground.
- D. Do not place concrete on ground with standing water or when upper 2 inches of ground is saturated.

- E. Do not place concrete during rain, sleet, or snow.
- F. Vapor Barrier (where required for floor slab on grade):
 - 1. Install per ASTM E1643.
 - 2. Place membrane over compacted fill prior to placement of base fill; minimum number of joints.
 - 3. Overlap sheets and seal joints with tape according to manufacturer's recommendations.

3.04 CONCRETE CONVEYING

- A. Deliver concrete from the mixer to the place of final deposit as rapidly as practical by methods, which will prevent segregation or loss of ingredients.

3.05 CONCRETE DEPOSITING

- A. Deposit concrete continuously or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.
- B. Place concrete at such a rate that the concrete which is being integrated with fresh concrete is still plastic.
- C. Do not deposit concrete which has partially hardened or has been contaminated by hardened materials.
- D. Remove rejected concrete from the Site.
- E. Deposit concrete as nearly as practicable in its final position to avoid segregation due to handling or flowing.
- F. Free fall of concrete shall not exceed 4 feet. Use chutes equipped with hopper heads for placing where a drop of more than 4 feet is required.

3.06 PLACING CONCRETE SLABS

- A. Deposit and consolidate concrete slabs in a continuous operation.
- B. Consolidate concrete placed in slabs by vibrating bridge screeds, roller pipe screeds, or other methods acceptable to Engineer.
 - 1. Bring slab surfaces to the correct level with a straight edge and then strike off.
 - 2. Use bullfloats or darbies to smooth the surface, leaving it free from bumps and hollows.
- C. Do not leave screed stakes in concrete.
- D. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to start of finishing operations.

3.07 COLD WEATHER PLACING

- A. Do not place concrete when the air temperature is less than 40 degrees F. without the specific approval of Engineer.
- B. Cold Weather Concrete Work: ACI 306.1, except as modified by the requirements of these Contract Documents.
- C. Do not place concrete against any frozen substrate, including subgrade soils and surfaces of formwork.
- D. Do not place concrete around any embedment, including reinforcing steel that is at a temperature below freezing.
- E. The temperature of the concrete delivered at the site shall conform to the following limitations:

Air Temperature	Minimum Concrete Temperature	
	< 12 Inches Thick	12-36 Inches Thick
Above 30° F	60° F	55° F
0° to 30° F	65° F	60° F
Below 0° F	70° F	65° F

- F. If water or aggregate is heated above 100 degrees F., combine water with the aggregate in the mixer before cement is added. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 degrees F.
- G. When the mean daily temperature is less than 40 degrees F., maintain the temperature of the concrete between 50 and 70 degrees F. for the required curing period.
- H. Arrangements for Heating, Covering, Insulation, Or housing the Concrete Work:
 - 1. Made in advance of placement.
 - 2. Adequate to maintain the required temperature without injury due to concentration of cold or heat.
 - 3. Keep protection in place for a minimum of 3 days.
- I. Do not use combustion heaters during the first 24 hours, unless precautions are taken to prevent exposure of the concrete to exhaust gases.
- J. Once the cold weather concrete protection is removed, continue concrete curing for the remainder of the 10 day curing period.

3.08 HOT WEATHER PLACING

- A. Comply with ACI 305 when hot weather conditions exist.
- B. Maintain concrete temperature at time of placement below 90 degrees F.
- C. When the temperature of the steel is greater than 120 degrees F., spray steel forms and reinforcement with water prior to placing concrete.

- D. Keep all surfaces protected from rapid drying. Provide windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering in advance of placement.

3.09 CONSOLIDATION

- A. Consolidate all concrete according to provisions of ACI 309.
- B. Consolidate each layer of concrete immediately after placing by use of internal concrete vibrators. Maintain a frequency of not less than 8,000 vibrations per minute for each internal vibrator.
- C. Provide adequate number of units and power source at all times. Use a minimum of 2 vibrators for all work and maintain spare units to ensure adequacy.
- D. Insert the vibrator so as to penetrate the lift immediately below the one being placed. Do not insert the vibrator into lower courses which have begun to set.
- E. Limit spacing between insertions of the vibrator to 12-18 inches and do not exceed twice the radius of action as shown in ACI 309 or 18 inches.
- F. Do not use vibrators to transport concrete inside the forms.
- G. Vibrate concrete to minimize entrapped air and surface voids on formed surfaces.

3.10 CONCRETE SLAB FINISHING

- A. Coordinate finishing of integrally colored floor slabs that are scheduled to have a mechanically polished finish with section 03 35 22.
- B. Float Finish:
 - 1. Apply float finish to all slab surfaces.
 - 2. After placing and screeding concrete slabs, do not work the surface until ready for floating. Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power-driven float.
 - 3. Consolidate the surface with power-driven float or by handfloating if the area is small or inaccessible to power units.
 - 4. Check and level the surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straight-edge placed on the surface at not less than 2 different angles.
 - 5. Immediately after leveling, refloat the surfaces to a smooth, uniform, granular texture.
- C. Trowel Finish:
 - 1. Apply steel trowel finish to all interior floor slabs, topping, and stair treads and all tank slabs which do not receive a concrete topping.
 - 2. Apply float finish to slabs as described above in Part 3.11.A.

3. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
 4. Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8 inch in 10 feet when tested with a 10 foot straight-edge.
- D. Broom Finish:
1. Apply non-slip broom finish to all exterior sidewalks and aprons.
 2. Apply float finish to slabs as described above in Part 3.11.A.
 3. Immediately after floating, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use a fiber-bristle broom.

3.11 FINISHING FORMED SURFACES

- A. Provide a smooth formed surface to all formed surfaces not exposed to view, unless otherwise noted in Paragraph B. Smooth formed finish shall consist of the following:
1. Construct formwork according to Section 03 11 00.
 2. Patch all tie holes and defects larger than 1/8-inch in diameter and/or 1/8 inch deep.
 3. Remove all fins, seams and concrete “buttons” protruding more than 1/16 inch.

3.12 CURING

- A. Immediately after placement, damp cure all concrete for a minimum of 7 days.
- B. Cover all slabs and topping with approved burlap-polyethylene film and keep in place throughout the curing period.
- C. Cover walls, beams, columns and other formed surfaces with burlap-polyethylene film or spray with an approved curing compound.
- D. Anchor all burlap-polyethylene film at the edges to prevent moisture loss.
- E. Rewet all slab surfaces at least once a day during the curing period.
- F. Concrete slabs to be mechanically polished shall be wet cured according to ACI 308R-01. Use of curing compounds is not acceptable.

3.13 PATCHING

- A. Repair honeycomb and other defective areas, fill surface voids, and fill form tie holes and similar defects according to ACI 301.

- B. Inject concrete cracks as observed during construction and leak testing operations with epoxy to manufacturer's recommendations. Confirm procedures with owner and Engineer prior to installation.
- C. Reinforce or replace deficient work as directed by Engineer and at no additional cost to owner.

3.14 CLEAN UP AND DISPOSAL

- A. Upon completion of the walls and prior to any painting, thoroughly clean all exposed or painted concrete surfaces of all concrete spatters, form oil, or other foreign material detrimental to appearance or painting.
- B. Remove all excess concrete debris remaining after completion of placement and form removal from the Site and dispose of in a proper and legal manner.

3.15 ANCHORING DOWELS

- A. Drill hole in concrete to the size and depth recommended by the adhesive supplier and as approved by Engineer.
- B. Clean hole with a nylon brush and use compressed air to blow out hole.
- C. Fill hole with anchoring adhesive according to manufacturer's recommendations.

3.16 FIELD QUALITY CONTROL

- A. Concrete Strength Tests:
 - 1. Mold and cure 4 specimens from each sample according to ASTM C31. Record any deviations from the requirements of ASTM C31 in the test report.
 - 2. Test specimens according to ASTM C39. Test 2 specimens at 28 days for acceptance and 1 at 7 days for information. Test 1 specimen at 56 days if desired by Engineer.
 - 3. Conduct at least 1 strength test for each 100 cu.yds. or fraction thereof for each mixture design placed in any 1 day.
 - 4. Furnish a copy of the test results to Engineer as soon as available.
 - 5. Costs of concrete cylinder testing will be paid by owner.
 - 6. Mold and field cure specimens as required in ASTM C31.
 - 7. Acceptance test results shall be the average strengths of the 2 specimens tested at 28 days.
 - 8. Conduct load test on test cores of concrete that fail to meet the specified strength, according to ASTM C42.
 - 9. Failure to meet strength requirements of the cores, shall be a cause for rejection by Engineer.
 - 10. The cost of remedial measures required due to test failures shall be paid for by contractor.
- B. Engineer may request adjustment to concrete mixes when characteristics of materials, job conditions, weather, test results, other circumstances warrant.

- C. Concrete Slump Tests:
1. Owner will determine slump of concrete from each truck according to ASTM C143.
 2. If slump exceeds maximum allowed, remove batch from work and dispose of off-site.
 3. Test slump at end of conveying system.
 4. All costs of slump testing will be paid by owner.
- D. Concrete Air Content Tests:
1. Owner will determine air content of concrete from each truck according to ASTM C231.
 2. Air content shall be tested at end of conveying system.
 3. All costs of air content testing will be paid by owner.
- E. Concrete Temperature:
1. Owner will determine temperature of concrete from each truck according to ASTM C31.
 2. Test temperature at end of conveying system.
 3. All costs of temperature testing will be paid by owner.

Table 2-1

	f'c @ 28 days	Maximum Water/Cement + Pozzolan Ratio	Maximum Pozzolan Content (percent of cement content)¹	Aggregate	Entrained Air Content (Refer to ACI 350, Moderate Exp.)	Slump (inches) before and after superplasticizer
A. Concrete for walls, grade beams, slabs, beams, columns, base slabs, pads and all other concrete unless noted below.	4,000 psi	0.45	ACI 350 - Table 4.2.3	Section 2.01.B	ACI 350 - Table 4.2.1	2 ± 1 before 6 ± 1 after

¹Or with Engineer's prior approval

SECTION 03 35 22 - MECHANICAL POLISHED CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Provide mechanical polished concrete finish for interior concrete cast-in-place flatwork.
- B. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete

1.02 REFERENCES

- A. ACI 1302 - Guide for Concrete Floor and Slab Construction
- B. ANSI:
 - 1. B101.1 – Static Coefficient of Friction
 - 2. B101.3 – Dynamic Coefficient of Friction
- C. ASTM:
 - 1. C33 - Aggregate Conformity
 - 2. C150 - Type 1, 11 Portland Cement Conformity
 - 3. C779 - Abrasion of Horizontal Concrete Surfaces
 - 4. C805 - Impact Strength
 - 5. D2047 - Coefficient of Friction
 - 6. G152 - Ultraviolet Light and Water Spray
- D. National Floor Safety Institute www.nfsi.org

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Labor, material, equipment, and services necessary for dry or wet diamond grinding and polishing.
 - 2. Application of densifying impregnator, penetrating stain guard, and polishing to specified sheen level and aggregate exposure.
- B. Performance Requirements: Finished concrete shall have a minimum Floor Flatness rating of 50.

1.04 SUBMITTALS

- A. Provide submittals according to Division 01.
- B. Product Data: Submit manufacturer's current Product Data for each grinding machine, including all types of grinding heads, dust extraction systems, joint filler, concrete densifying impregnator, penetrating stain guard, and any other products used in the process, plus installation instructions and maintenance and cleaning recommendations.
- C. Coefficient of Friction: Submit written test results to architect.
- D. Quality Assurance/Control Submittals:
 - 1. Certification: Applicator's qualification data.
 - 2. Qualifications: Submit list of at least 6 completed projects, including project name, project address, and owner contact information.
 - 3. Maintenance Manual: Provide to the owner, maintenance and warranty data in "Maintenance Manual" compliant with Section 01 77 00.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Minimum of 5 years' experience in the production of polished concrete products.
 - 2. Applicator: Minimum 3 years' experience in polished concrete applications and successfully completed not less than 6 projects comparable in scale and complexity.
- B. Regulatory Requirements:
 - 1. Products shall comply with the United States Clean Air Act for maximum Volatile Organic Compound (VOC) content.
 - 2. Conform to requirements of Authorities Having Jurisdiction.
- C. Mockups:
 - 1. Coordinate mockup with section 03 30 00.
 - 2. Mockup size shall be a minimum of 10-feet by 10-feet.
 - 3. Erect mock-up in presence of architect after having provided 7 days notification of date and time when mockup is to be constructed.
 - 4. Include control joints and edges in mock-up.
 - 5. Mock-ups are to verify selections made under sample submittal and to demonstrate methods and workmanship proposed for the Project.
 - 6. Acceptance: Obtain architect's written acceptance of mock-up before start of Work.
 - 7. Maintenance: Retain approved mock-ups through completion of the Work for use as a quality standard for finished Work.
 - 8. Accepted mock-up in undisturbed condition at time of Substantial Completion may become part of completed unit of Work.
- D. Preinstallation Meetings: Conduct conference at Site to comply with requirements of Section 01 31 19.

1.06 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field verify dimensions and assume full responsibility for their accuracy.
- B. Maintain work area temperature, humidity, and ventilation within limits recommended by manufacturer of any products used for application.
- C. Job site lighting shall be operational and sufficient light shall be provided for the process.
- D. New concrete shall have cured a minimum of 45 days prior to initiating the installation of concrete polishing, processing and finishing work.

- E. Ensure floor areas to be polished are free and clear of obstacles including racking, fixtures, and temporary equipment and materials in order to provide open and empty concrete slab.
- F. Remove anchoring bolts, cut off conduit, and other associated items removed in demolition process, or recess a minimum of 1/4 inch below lowest surrounding point of concrete floor surface.
- G. Take caution to ensure that no damage to concrete floor takes place since slab will be finish product.
- H. Do not start installation of polished concrete system until concrete patching has cured a minimum of 45 days.
- I. Protection: Protect area to receive polished concrete finish during construction to prevent oils, dirt, metal, excessive water, and other potentially damaging materials from affecting finished concrete surface. Begin protection measures listed below immediately after concrete slab is poured:
 - 1. Diaper hydraulic powered equipment to avoid staining of concrete.
 - 2. Do not park vehicles on finish slab area. If vehicles are necessary to complete Work, place drop cloths under vehicles while parked on slabs.
 - 3. Do not use pipe cutting machine on finish floor slab.
 - 4. Do not place steel on finish slab to avoid rust staining.
 - 5. Prevent acids from coming in contact with slab. Do not charge battery powered equipment on floor areas to be polished.
 - 6. Use drop cloths on concrete. If paint gets on concrete, immediately remove it.
 - 7. Do not allow skids to remain in contact with floor surface for extended period of time.
 - 8. Inform trades that slab shall be protected at all times.
- J. Contractor shall coordinate with the general contractor and provide storage units as required.
- K. HVAC return grilles in work area shall be filtered.
- L. Contractor shall not begin grinding or polishing until all dust control measures indicated are installed.
- M. Contractor shall provide power source for all electrical equipment required to complete the project. Contractor shall coordinate with general contractor regarding generator location, operating times, noise considerations, fuel storage, etc. Generator shall run quietly and exhaust shall be managed to prevent exhaust fumes from entering the parking area or the building through air intakes, grilles, open doors, etc.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete:

1. Coordinate with section 03 30 00 for concrete mix design.
2. Keep admixtures, plasticizers, slag, fly ash additives to a minimum.
3. Do not use calcium chloride-based admixtures.
4. Mix design to be approved by architect.
5. Saw cut patterns as shown on drawings.

B. Penetrating Liquid Densifying Impregnator:

1. Chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components.
2. Odorless, colorless.
3. Hardens and densifies concrete surfaces.
4. Resistant to abrasion, dusting, and absorption of liquids.
5. Acceptable Manufacturers:
 - a. QuestMark 7923 DiamondGuard II
 - b. National Polymers, Inc. NP7936 one component water based, lithium based solution.
 - c. National Polymers, Inc. NP7937 one component water based, lithium based solution.
 - d. Convergent Concrete Technologies, LLC Pentra-Sil NL water based, lithium based solution
 - e. Lythic Solutions, Inc. Lythic Densifier, Colloidal Silica Concrete Hardener and Densifier.
 - f. Prosoco, Inc. Consolideck LS Lithium Silicate densifier.
 - g. The Euclid Chemical Company UltraSil Li + water based lithium silicate densifier, and sealer.
 - h. Concrete Polishing Solutions Armor Densifier, aqueous Lithium polysilicate solution.
 - i. W. R. Meadows, Inc. Liqui-Hard Ultra water based lithium silicate densifier and hardener.
 - j. Approved equal.

C. Penetrating Stain Guard:

1. Acceptable Manufacturers:
 - a. QuestMark 7924 DiamondGuard Plus densifier and stain inhibitor. Solvent-free lithium silicate and polymer surface application.
 - b. National Polymers 7940 Stain Inhibiter. One component water-based organic polymer and silane/siloxane surface conditioner and stain guard.
 - c. Convergent Concrete Technologies, LLC Pentra-Guard HP surface hardener and protective clear coat. Hybrid organic/inorganic nano lithium surface treatment.
 - d. Lythic Solutions, Inc. Lythic Protector, Colloidal Silica protection coat.

- e. Prosoco, Inc. Consolideck LS Guard lithium silicate and copolymer formulation.
 - f. The Euclid Chemical Company UltraGuard lithium silicate and polymer formulation.
 - g. Approved equal.
- D. Control Joint and Sawcut Filler:
 - 1. 2-part epoxy or polyurea.
 - 2. Acceptable Manufacturers:
 - a. QuestMark 5830 Fast Set Flexible Joint Sealant. Two component 100% solids polymer system.
 - b. Metzger/McGuire Spal-Pro RS 88 polyurea joint filler.
 - c. The Euclid Chemical Company QWIKjoint polyurea joint filler.
 - d. Approved equal.
 - e. Color: to be selected by architect.

2.02 FINISHES

- A. Level of Finish:
 - 1. Polished Concrete Level 2: At a distance of 30 to 50 feet the floor will clearly reflect from side and overhead lighting (800 grit).
- B. Aggregate Exposure:
 - 1. Grade-1 Light Sand Finish: Minimal aggregate exposure; no aggregate larger than 1/8 inch.
- C. Edges:
 - 1. Polished: Edges finished in conjunction with polishing process to provide a seamless finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing Work, carefully inspect and verify that Work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that mechanical polished concrete floor finish may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Confirm that minimum of 45 days has elapsed for new slab pours prior to installation. Confirm if curing agents or hardening agents have been applied.
- D. Discrepancies: Immediately notify architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PROTECTION

- A. Protect areas to receive polished concrete finish at all times during construction to prevent oils, dirt, metal, excessive water, and other potentially damaging materials from affecting the finished concrete surface.
- B. Diaper all hydraulic powered equipment to avoid staining the concrete.
- C. Prohibit vehicle parking on the finished slab area. If necessary to complete Work, use drop clothes under vehicles at all times.
- D. Protect slab from indentions and footprints during pour and curing.

3.03 PREPARATION

- A. Coordinate integrally colored floor slab installation with section 03 30 00.
- B. See section 03 30 00 for floor flatness and levelness tolerances.
- C. Remove oil, grease, dirt, slab coatings, loose concrete if any and other contaminates that may affect the final finish.
- D. Inspect substrate to assure satisfactory surfaces. Identify conditions or defects that cannot be mitigated through the concrete polishing, processing and finishing process including filling, patching and repair procedures specified herein.
- E. Repair of isolated surface defects:
 - 1. Rout edges of spalls/pits to form 1/2" deep "shoulder" at edges.
 - 2. Clean area of defect with grinder or wire brush to remove all loose material and laitance. Vacuum.
 - 3. At spalled joints install edge form as required. Treat form with non-staining release agent.
 - 4. Mask edges of repair with tape and install Patching Material.
 - 5. Allow Patching Material to cure per manufacturer's recommendations.
 - 6. Polish/finish to match adjacent floor finish.
- F. Repair of multiple minor surface defects and irregularities:
 - 1. Clean defects with wire wheel to remove all loose material and laitance. Vacuum.
 - 2. Apply Patching Material generously in and around defects.
 - 3. Trowel Patching Material flush with slab surface and repeat troweling in opposite directions until material begins to thicken.
 - 4. Allow Patching Material to cure per manufacturer's recommendations.
 - 5. Grind-off overfill, ensuring that Patching Material is flush with slab surface.
 - 6. Inspect and reapply as required until smooth surface is achieved.

- G. Large surface repair:
1. Rout or saw cut edges of spalls/pits to form 1/2" deep "shoulder" at edges.
 2. Roughen surface and vacuum clean. Inspect and remove all loose material with wire brush and vacuum.
 3. Mask edges of repair with tape.
 4. Where required by Patching Material manufacturer, install bonding agent.
 5. Install Patching Material and float level per manufacturer's recommendations.
 6. Trowel until surface is level and smooth without defects.
 7. Allow Patching Material to cure per manufacturer's recommendations.
 8. Polish/finish to match adjacent floor finish.
- H. Repair of cracks up to 1/8" in width:
1. Clean crack cavity:
 - a. Lightly rake crack with sharp tool.
 - b. Remove all loose segments including islands formed by crack.
 - c. Do not route, saw cut or widen joint.
 - d. Vacuum crack to remove all dirt, debris and laitance.
 2. Mask slab surface along crack as required.
 3. Install Crack Repair Material per manufacturer's recommendations until material crowns the floor surface without voids.
 4. Cure sufficiently per manufacturer's recommendations and shave Crack Repair Material flush with floor surface using razor scraper.
- I. Polish crack repair area to blend surface.
1. Repair of cracks greater than 1/8" up to 1/4" wide:
 - a. Rout top of crack to provide square edge - 1/2" deep x minimum 1/8" wide, maximum 1/4" wide.
 - b. Clean crack cavity. Vacuum crack to remove all dirt, debris and laitance.
 - c. Mask slab surface along crack as required.
 - d. Prime crack per Crack Repair Material manufacturer's recommendations.
 - e. Deposit silica sand into crack to within 1/8" to 1/4" from top of floor surface.
 - f. Install Crack Repair Material per manufacturer's recommendations until material crowns the floor surface without voids.
 - g. Cure sufficiently per manufacturer's recommendations and shave Crack Repair Material flush with floor surface using razor scraper.
 - h. Polish crack repair area to blend surface.
- J. Saw cut control joints: To be provided by general contractor as part of interior fit-out scope of work.
1. Clean joint of dirt, debris, coatings, etc. Joints must be free of all laitance and visible moisture. Joints shall have continuous, square edges without spalls or voids.

2. If necessary, re-saw the joint to a depth of 3/4" with a dry cut, vacuum-equipped saw using a slightly oversized blade. Blade shall be wide enough to remove edge spalls and to produce square corners on both sides of the joint. Total joint width shall be 3/4" maximum.
3. Install joint filler material into the irregular portion of the contraction joint below the saw cut portion. Allow joint filler to set-up and bond to the irregular surfaces of the joint.
4. Mask edges of joint as required and install 1/8" deep max. layer of silica sand into the bottom of the saw cut portion of the joint to serve as a bond break. Install joint filler material per manufacturer's recommendations until material crowns the floor surface without voids.
5. Cure sufficiently per manufacturer's recommendations and shave joint filler material flush with floor surface using razor scraper.

3.04 INSTALLATION

- A. Concrete polishing, processing and finishing process - Finish Level #2
 1. Mechanically grind floor surface with #40 grit metal bonded diamonds (16, 25 grit prior if necessary) removing construction debris and floor slab imperfections. Continue until scratch pattern is uniform and fine aggregate exposure is achieved. Vacuum the floor thoroughly using a squeegee vacuum attachment.
 2. Mechanically grind floor surface with #80 grit metal bonded diamonds removing excess grout coat and all scratches from previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
 3. Mechanically grind floor surface with #150 grit metal bonded diamonds or Hybrid diamond tool removing all scratches from previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
 4. Clean floor surface thoroughly using water and an AutoScrubber.
 5. Apply densifier at approximately 200 square feet per gallon using a stiff, long bristled broom. Cover the entire work area liberally and allow to soak for ten (10) minutes. Re-apply to areas where the densifying impregnator has soaked in and allow to sit for an additional thirty (30) minutes. Squeegee or AutoScrub excess material off of floor. Allow 1-2 hours to dry before proceeding.
 6. Mechanically grind floor surface with #100 resin bonded diamonds to begin the process of creating the initial shine. Clean floor surface with clean water and an AutoScrubber or a mop and a wet vacuum.
 7. Mechanically grind floor surface with #200 resin bonded diamonds to finish the process of creating the initial shine. Clean floor surface with clean water and an AutoScrubber or a mop and a wet vacuum.
 8. Start the polishing process utilizing #400 grit resin bonded diamonds to improve the shine and remove swirls in the concrete. Clean floor surface with clean water and an AutoScrubber or a mop and a wet vacuum.
 9. Continue the polishing process utilizing #800 grit resin bonded diamonds to improve the shine and remove swirls in the concrete. Clean floor surface with clean water and an AutoScrubber or a mop and a wet vacuum.

10. Apply densifier using two light coats applied with a micro fiber mop. Allow to first coat to dry before applying second coat. Once second coat is dry to the touch, allow additional 20 minutes before proceeding to the next step.
 11. Resume the polishing process utilizing #1500 grit diamond pad and burnisher in order to heat cure the densifier per manufacturer's recommendations and provide the final shine.
 12. Apply light coating of Stain Inhibiter using micro fiber mop. Allow to dry. Burnish using #1500 grit diamond pad and high speed burnisher in order to heat cure the Stain Inhibiter per manufacturer's recommendations and provide the final shine.
- B. Vacuum floor thoroughly after each grind using a squeegee vacuum attachment.
- C. Fill construction joints with specified filler according to manufacturer's instructions.
1. Color: Match with concrete color.

3.05 GLOSS and SLIP RESISTANCE TESTING

- A. Contractor shall perform testing and provide certification to owner that the finished installation conforms to specified requirements for gloss and static coefficient of friction (SCOF). Testing shall be performed with contractor's equipment and may be observed by the owner's Project Manager.
- B. Owner reserves the right to have an independent testing service verify gloss levels prior to acceptance using a Horiba IG-320 Gloss Checker with measurement angle set to 60 degrees. Gloss readings shall be taken at each of the test locations indicated in article 3.03.C below with four (4) readings taken at each location. The average of all of the readings shall be a minimum of 55.
- C. Contractor shall have an independent testing service verify static coefficient of friction (SCOF) levels prior to acceptance, using an American Slip Meter, Inc. ASM 725 or ASM 825 horizontal slip meter. SCOF readings shall be taken at five (5) test locations. Four (4) SCOF readings shall be taken at each test location. The average of the four (4) readings in each test location shall have a minimum SCOF of 0.6. Each test location shall have a minimum average SCOF of 0.6.

3.06 DEMONSTRATION

- A. Maintenance instructions: Manufacturer's representative to schedule and attend meeting with owner's representatives to explain:
1. Recommended Maintenance Program.
 2. Warranty Requirements.

3.07 PROTECTION

- A. Protect floor from traffic for at least 72 hours after final application of sealer, or for time period recommended by manufacturer.
- B. Do not allow marking of the floor.

- C. Do not apply chemicals of any kind to floor.
- D. Do not allow acids and acidic detergents to come into contact with slab.
- E. Do not use pipe cutting machine on the finished floor slab.
- F. Do not place steel on the finished slab to avoid rusting.
- G. Painters to use drop cloths on the concrete. Immediately remove any paint splatter or drops on concrete.
- H. Provide final protection and maintain conditions in a manner acceptable to manufacturer to ensure Work is without damage or deterioration at time of Substantial Completion. Prevent spills.

SECTION 03 45 00 - PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Provide precast architectural concrete units, including:
 - 1. Sills.
 - 2. Caps for site features and gabions.
 - 3. Reinforcing materials.
 - 4. Accessories including, but not limited to:
 - a. Connecting materials.
 - b. Grout materials.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete
 - 2. Section 04 20 00 - Unit Masonry Assemblies
 - 3. Section 04 43 00 – Stone Masonry
 - 4. Section 07 92 00 - Joint Sealants

1.02 REFERENCES

- A. ACI:
 - 1. 216 - Fire Resistance
 - 2. 318 - Building Code Requirements for Reinforced Concrete
- B. ASTM:
 - 1. A36 - Carbon Structural Steel
 - 2. A82 - Specifications for Cold Drawn Steel Wire for Concrete Reinforcement
 - 3. A123 - Hot Dip Galvanized Coatings on Steel Products
 - 4. A153 - Zinc-Coating Iron and Steel Hardware

5. A185 - Specifications for Wire Fabric for Concrete Reinforcement
6. A276 - Stainless Steel Bars and Shapes
7. A307 - Carbon Steel Bolts and Studs
8. A615 - Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement
9. A666 - Cold-Worked Austenitic Stainless Steel Sheets, Plates, Strips
10. C33 - Concrete Aggregates
11. C144 - Aggregate for Masonry Mortar
12. C150 - Portland Cement
13. C260 - Air Entraining Admixtures for Concrete
14. C1107 - Packaged Dry Nonshrink Hydraulic Cement Grout

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings:
 1. Detail fabrication and installation.
 2. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.
- D. Samples:
 1. For each type of finish indicated on exposed surfaces of concrete units, illustrate full range of finish, color, and texture variations expected.
 2. Color charts showing full range of colors for grout.
- E. Design Mixes: For each concrete mix.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide plant-precast architectural concrete units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Manufacturer Qualifications: 5 years' experience in the manufacture of plant-precast architectural concrete units.
- C. Regulatory Requirements:
 1. Comply with referenced industry standards.
 2. Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook for Precast and Prestressed Concrete."

D. Field-Erected Mockups:

1. Before installing architectural precast concrete units, erect mock-up for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
2. Build mock-up to comply with the following requirements, using materials indicated for final unit of work.
 - a. Location: Locate mock-up on site in location and size indicated.
 - b. Erect mock-up in coordination with materials in section 04 20 00 and 04 43 00.
 - c. Scope: Demonstrate the proposed range of aesthetic effects and workmanship.
 - d. Acceptance: Obtain architects acceptance of mock-up before start of final unit of work.
 - e. Maintenance: Retain and maintain mock-up during construction in undisturbed condition as a standard for judging completed unit of work.
3. Accepted mock-up in undisturbed condition at time of Substantial Completion may become part of completed unit of work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Coordination:

1. Coordinate as required with other trades to ensure proper and adequate provision in work of those trades that interfaces with work of this section.
2. Deliver units to site in such quantities and at such times to ensure continuity of installation.
3. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work.

B. Handling: Lift and support units only at designated lifting and supporting points shown on Shop Drawings.

1.06 PROJECT CONDITIONS

A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Standard of Quality: Design is based on products of American Artstone Company, New Ulm, MN

- B. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
1. Amcon Block and Precast Inc., St. Cloud, MN
 2. County Materials, Eau Claire, WI
 3. Edwards Cast Stone, Dubuque, IA
 4. Stoneworks, Elk River, MN www.stoneworksap.com
 5. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Concrete:
1. Cement: White Portland cement, conforming to ASTM C150, Type I.
Aggregates: Conform to ASTM C33 for “severe weathering region”; hard, durable, carefully selected and graded.
 2. Water: Clean and free from oils, acids, alkalis, organic material, salts, other deleterious matter.
 3. Admixtures:
 - a. Use air-entraining admixture conforming to ASTM C260.
 - b. Architect must specifically approve use of any other admixtures.
- B. Supplementary Cementitious Materials:
1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
 2. Metakaolin Admixture: ASTM C618, Class N.
 3. Silica Fume Admixture: ASTM C1240, with optional chemical and physical requirement.
 4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
- C. Reinforcement:
1. Bars: Deformed billet steel complying with ASTM A615; new, free from rust and kinks, Grade 60.
 2. Plain Steel Welded Wire Fabric: Comply with ASTM A185, of sizes and gages shown on Drawings.
 3. Plain Steel Wire for Reinforcement: Comply with ASTM A82.
 4. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place.
- D. Items embedded in concrete shall meet or exceed the following standards:
1. Welded Studs: AWS D1.1.
 2. Steel Bolts and Nuts, Studs: ASTM A307, Grade A.
 3. Galvanized Finishes: ASTM A123 and A153.
- E. Grout:
1. Sand-Cement Grout: Portland cement, ASTM C150, Type 1, and clean, natural sand, ASTM C144.

- F. Mortar: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144, with minimum water for placement.
- G. Accessories: Provide clips angles, seat angles, anchors, dowels, hangers, plastic shims, and other accessories required to install precast architectural concrete units to supporting and adjacent construction.

2.03 FABRICATION

- A. Fabricate work to sizes and shapes indicated, and of texture matching approved samples.
- B. Finished units to be straight, true to size and shape, and within specified casting tolerances; exposed edges sharp, straight, and square; flat surfaces in a true plane.
- C. Warped, cracked, broken, spalled, stained, and otherwise defective units will not be acceptable.
- D. Place and secure in form with anchors, clips, stud bolts, inserts, lifting devices, shear ties, other devices required for handling and installing precast units and for attachment of subsequent items as indicated or specified.
- E. Cast in reglets, slots, holes, and other accessories to receive dowels, flashings, and other similar work.
- F. Reinforcement:
 - 1. Clean loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position and support against displacement during concrete placement operations.
 - 3. Completely conceal support devices to prevent exposure on finished surfaces.
 - 4. Place to maintain minimum 3/4 inch coverage.
 - 5. Arrange, space, and securely tie bars and supports. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 6. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces minimum of 1 full mesh and lace splices with wire. Offset laps of adjoining widths.
- G. Curing:
 - 1. Form cure minimum 20 hours by moisture retention method.
 - 2. Keep wet continuously for at least 6 days after being removed from the forms.
 - 3. Following curing period, allow the units to air dry for at least 4 days before shipping to Site.

2.04 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
- B. Compressive Strength (28 days): 6,000 psi.
- C. Water Absorption: 8 to 10 percent by volume.

2.05 FINISHES

- A. Exposed Textures: Fabricate precast units and provide exposed surface finishes as:
 - 1. Sandblasting: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 - a. Exposure:
 - 1) Light exposure: Only surface skin of cement and sand is removed, just sufficiently to expose the tips of the closest course aggregate.
- B. Color:
 - 1. Pigments: Match color 17-13 MAE by American Artstone.
 - 2. Use white Portland cement if required to achieve selected color.

2.06 SOURCE QUALITY CONTROL

- A. Fabrication Tolerance: Pockets larger than 1/16-inch diameter will not be acceptable.
- B. Joints: No miter joints at corners will be acceptable. If it is necessary to fabricate in more than 1 piece, joints must be located a minimum of 4 inches from corner units.
- C. Fabricate units according to ACI 318 and the National Precast Concrete Association's Quality Control Manual for Precast Plants.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verification of Conditions: Verify that plant-precast architectural concrete units may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.

3.02 INSTALLATION

- A. Install in strict accordance with original design, approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, manufacturer's recommended installation procedures as approved by architect.

- B. Erection:
1. Install connection materials and other accessories required for connecting precast architectural concrete units to supporting members and backup materials.
 2. Install precast architectural concrete units providing temporary supports and bracing as required to maintain position, stability, and alignment.
 3. Maintain horizontal and vertical joint alignment and uniform joint width.
 4. Anchor units in position by grouting, or as otherwise indicated.
 5. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.
- C. Grouting Connections:
1. Grout connections where indicated on Drawings.
 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. Keep grouted joints damp for minimum 24 hours after initial set.
 6. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.03 CLEANING AND ADJUSTING

- A. Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete, as directed by architect.
- B. Remove and replace damaged units if repairs do not comply with requirements.
- C. Remove temporary covering and other provisions made to minimize soiling of other work.
- D. When work is completed, remove unused materials, containers, equipment, and debris.
- E. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
1. Follow fabricator's written recommendations for cleaning.
 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes

DIVISION 4 - MASONRY

SECTION 04 20 00 - UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Concrete masonry:
 - a. Concrete veneer brick.
 - b. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Insulation:
 - a. Cavity wall.
 - b. Spray foam sealant.
 - 4. Embedded membrane flashings.
 - 5. Reinforcing steel.
 - 6. Joint reinforcement.
 - 7. Ties and anchors.
 - 8. Masonry accessories.
- B. Installation of material furnished by other sections, including, but not limited to:
 - 1. Architectural precast concrete.
 - 2. Stone Masonry.
 - 3. Loose steel lintels.
 - 4. Sleeves.
 - 5. Embedments.
 - 6. Hollow metal frames in masonry walls.
- C. Perform the following:
 - 1. Preparation of openings in masonry for recessed items.
- D. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete
 - 2. Section 03 45 00 - Precast Architectural Concrete
 - 3. Section 04 43 00 – Stone Masonry
 - 4. Section 05 12 00 - Structural Steel Framing
 - 5. Section 05 50 00 - Metal Fabrications
 - 6. Section 06 10 500 - Rough Carpentry
 - 7. Section 06 17 53 – Shop-Fabricated Wood Trusses
 - 8. Section 07 11 13 - Bituminous Dampproofing
 - 9. Section 07 21 00 - Thermal Insulation
 - 10. Section 07 21 29 – Sprayed Insulation
 - 11. Section 07 22 16 – Roof Board Insulation
 - 12. Section 07 27 00 – Air Barriers
 - 13. Section 07 84 00 - Firestopping

14. Section 07 92 00 - Joint Sealants
15. Section 08 11 13 - Hollow Metal Doors and Frames (Commercial)
16. Section 08 43 13 - Aluminum-Framed Storefront
17. Section 10 28 13 - Toilet Accessories
18. Section 10 44 00 - Safety Specialties

1.02 REFERENCES

- A. ACI:
 1. 315, SP66 - Details and Detailing of Concrete Reinforcement
 2. 530.1 - Specifications for Masonry Structures
- B. ASTM:
 1. A53 - Pipe, Steel, Hot-Dipped, Zinc Coated
 2. A153 - Zinc Coating, Hot Dip, on Iron and Steel Hardware
 3. A307 - Carbon Steel Bolts and Studs.
 4. A496 - Steel Wire, Deformed, for Concrete Reinforcement
 5. A580 - Stainless Steel Wire
 6. A615 - Deformed and Plain-Billet Steel Bars for Concrete Reinforcement
 7. A641 - Zinc Coated Galvanized Carbon Steel Wire
 8. A951 - Masonry Joint Reinforcement
 9. C90 - Load Bearing CMU
 10. C91 - Masonry Cement
 11. C129 - Non-Loadbearing Concrete Masonry
 12. C140 - Concrete Masonry Units Testing
 13. C144 - Aggregates for Masonry Mortar
 14. C207 - Hydrated Lime for Masonry Purposes
 15. C270 - Mortar for Unit Masonry
 16. C404 - Aggregates for Masonry Grout
 17. C476 - Grout for Masonry
 18. C150 - Portland Cement
 19. C578 - Rigid Cellular Polystyrene Thermal Insulation
 20. C780 - Mortar Mixes
 21. C1019 - Grout Sampling and Testing
 22. C1093 - Testing Agency Qualifications
 23. C1142 - Ready-Mixed Mortar for Unit Masonry
 24. C1314 - Prism Compressive Strength
 25. C1329 - Mortar Cement
 26. D1056 - Flexible Cellular Materials
 27. E96 - Water Vapor Transmission
 28. E119 - Fire Tests of Building Construction and Methods
 29. E488 - Strength of Concrete and Masonry Anchors
 30. E514 - Water Penetration and Leakage Through Masonry
- C. AWS D1.4 - Structural Welding Code - Reinforced Steel

- D. BIA:
 - 1. M1 - Specifications for Portland Cement-Lime Mortar for Brick Masonry
- E. IBC Code: Currently in effect and adopted by state in which Project is located
- F. National Concrete Masonry Association: Tek 19-1 Water Penetration Resistance

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Provide unit masonry that develops the following installed compressive strengths (f'_m) at 28 days:
 - a. For Concrete Unit Masonry: Based on net area: $f'_m = 1900$ PSI (13.1 MPa).
 - 2. Provide unit masonry that meets or exceeds fire resistance requirements.
 - 3. Brick

1.04 SUBMITTALS

- A. Provide submittals as required by Division 01.
- B. Product Data:
 - 1. Mix designs for each type of mortar and grout, including description of type and proportions of ingredients.
- C. Shop Drawings:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315.
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- D. Samples:
 - 1. Samples for Verification Purposes: Unit masonry samples for each type of exposed masonry unit required.
- E. Quality Assurance/Control Submittals:
 - 1. Qualification Data:
 - a. Manufacturers, contractor: Include lists of completed, similar sized projects with project names and addresses, names and addresses of architects and owners, and other information specified.
 - b. Testing agency: ASTM C1093.
 - 2. Cold-weather Procedures: Describe methods, materials and equipment to be used to comply with cold-weather requirements, if applicable.
 - 3. Material certificates and test reports.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide materials made of components, with uniform texture and color or blend, furnished by one manufacturer for each type of masonry, mortar, aggregate and accessory.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of unit masonry.
 - 2. Contractor: 3 years experience in the installation of unit masonry.
 - 3. Personnel:
 - a. Foreman: Competent, in charge of work at all times, for duration of work unless otherwise permitted by architect.
 - b. Installer of masonry units: Skilled journeyman masons.
 - c. Mixer personnel: Thoroughly trained, with at least 1 person with 1 year experience (minimum) mixing mortar.
- C. Regulatory Requirements: Comply with pertinent requirements of governing authorities and referenced portions of ACI, NCMA and BIA industry standards.
- D. Certificate for Fire Performance and Characteristics: Certify materials and construction are in compliance with ASTM E119, by recognized testing and inspecting organization, or by other means, acceptable to authority having jurisdiction.
- E. Material Certificates and Test Reports: Provide statements and tests of material properties indicating compliance with standards for each type and size of the following:
 - 1. Masonry Units:
 - a. Material test reports and statement of compressive strength.
 - b. Concrete masonry units: ASTM C140.
 - c. Structural masonry units, including data and calculations establishing average net-area compressive strength of units.
 - 2. Prism: ASTM C1314.
 - a. Prisms shall consist of concrete block assembly such that 2 grouted face shell levels are in compressed zone and laid in stack bond.
 - 1) Masonry prism compressive strength: 2500 psi.
 - 3. Cementitious materials.
 - 4. Mortar: ASTM C780.
 - 5. Preblended, dry mortar mixes.
 - 6. Grout mixes: ASTM C1019.
 - 7. Reinforcing bars.
 - 8. Joint reinforcement.
 - 9. Anchors, ties, and metal accessories.
- F. Mockups:
 - 1. After award of Contract, before installing unit masonry, erect mock-up for each form of construction and finish required to verify selections made under sample submittals, and to demonstrate aesthetic effects as well as qualities of materials and execution.

2. Build mock-up to comply with the following requirements, using materials indicated for final unit of Work.
 - a. Location: Locate mock-up on-site.
 - b. Scope: Demonstrate the proposed range of aesthetic effects and workmanship.
 - 1) Coordinate and include materials from other sections in mockup to provide full aesthetic effect.
 - 2) Mockup shall be a minimum of 4-feet by 4-feet in size, larger if required to incorporate all exterior masonry materials.
 - c. Acceptance: Obtain architect's and owners acceptance of mock-up before start of final unit of Work.
 - d. Maintenance: Retain and maintain mock-up during construction in undisturbed condition as a standard for judging completed unit of Work.
 - e. Remove mock-up after Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection:
 1. Assume responsibility for acceptance of masonry units delivered to site being in compliance with specified ASTM requirements for chippage and dimensional tolerances.
 2. Comply with manufacturer's recommendations for job-site storage and protection.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements:
 1. Cold and Hot Weather Protection: Conform to recommendations for hot and cold weather masonry included in International Building Code.
 - a. Do not lay wet or frozen masonry units.
 - b. Ice or snow formed on masonry bed: Carefully apply heat until top surface is dry to touch.
 - c. Remove masonry damaged by freezing conditions.
 - d. If temperatures expected to fall below 40 degrees F within 12 hours, do not lay unless proper heated enclosures are provided.
 - e. Minimum temperature of masonry: 40 degrees F for 48 hours after installation.
 - f. In temperatures below 50 degrees F, use surface conditioner when installing flexible flashing.
 - g. Hot weather: Keep masonry moist until mortar has cured.
- B. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Concrete Masonry:

1. Standard of Quality: Design is based on products of Amcon Block and Precast Company, St. Cloud, MN www.amconblock.com
2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Anchor Block Company, North St. Paul, MN www.anchorblock.com
 - b. County Materials, Marathon WI www.countymaterials.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

B. Mortar and Grout Materials:

1. Portland Cement, Mortar Cement, Masonry Cement, and Lime: Acceptable manufacturers, subject to compliance with requirements, are:
 - a. Lafarge Corporation, Dallas, TX www.lafargenorthamerica.com
 - b. Lehigh Cement Company, Allentown, PA www.lehighwhitecement.com
 - c. Manufacturer of comparable products meeting requirements of specifications.
2. Water Repellent Admixture: Acceptable manufactures, subject to compliance with requirements are:
 - a. Rheopel Plus by BASF, www.basfbuildingsystems.com
 - b. DryBlock by Grace Construction Products, Cambridge, MA www.DryBlock.com
 - c. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
3. Premixed Mortar: Acceptable manufacturers, subject to compliance with requirements, are:
 - a. Spec Mix www.specmix.com
 - b. Quikrete
 - c. Manufacturer of comparable products meeting requirements of specifications.

C. Joint Reinforcement:

1. Standard of Quality: Design is based on products of Heckman Building Products, Inc., Chicago, IL www.heckmanbuildingprods.com
2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Dur-O-Wall Inc., Aurora, IL www.dur-o-wall.com
 - b. Hohmann & Barnard, Hauppauge, NY www.h-b.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

- D. Ties and Anchors:
1. Standard of Quality: Design is based on products of Heckman Building Products, Inc., Chicago, IL
 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Dur-O-Wall, Inc., Aurora, IL www.dur-o-wall.com
 - b. Hohmann & Barnard, Hauppauge, NY www.h-b.com
 - c. Masonry Reinforcing Corporation of America, Charlotte, NC www.wirebond.com
 - d. Manufacturer of comparable products meeting requirements of specifications.
- E. Insulation:
1. Rigid Cavity Wall Insulation: Acceptable manufacturers, subject to compliance with requirements, are:
 - a. DiversiFoam Products, Inc., New Brighton, MN www.diversifoam.com
 - b. Dow Chemical Company, Midland, MI www.dow.com/styrofoam
 - c. Owens Corning, Toledo, OH www.owenscorning.com
 - d. Pactiv Corporation, Atlanta, GA www.pactiv.com
 - e. Manufacturer of comparable products meeting requirements of specifications.
 2. Spray Foam Sealant: Acceptable manufacturers, subject to compliance with requirements, are:
 - a. Handi-Foam, Fomo OProducts Inc. www.fomo.com
 - b. Polycel, Polycel Foam Products, Sommerville, NJ www.polycel.com
 - c. Manufacturer of comparable products meeting requirements of specifications.
- F. Embedded Membrane Flashings:
1. Rubberized Asphalt Flashing: Acceptable manufacturers, subject to compliance with requirements, are:
 - a. CCW-705-TWF, Carlisle Corporation, Sapulpa, OK
 - b. Hohmann & Barnard, Inc. www.h b.com
 - c. Flashgard, Firestone Building Products, Carmel, IN
 - d. Miradri TWF, Nicolon-Mirafi Group, Norcross, GA
 - e. Perm-a-Barrier Wall Flashing, Grace Construction Products, Cambridge, MA
 - f. Sealtight, WR Meadows, Elgin, IL
 - g. Manufacturer of comparable products meeting requirements of specifications.
 2. Metal Flashings: Acceptable manufacturers, subject to compliance with requirements, are:
 - a. York Manufacturing, Sanford, ME www.yorkflashings.com
 - b. Wire-Bond, Charlotte, NC
 - c. Manufacturer of comparable products meeting requirements of specifications.

3. Stainless Steel Drip Plates: Acceptable manufacturers, subject to compliance with requirements, are:
 - a. Hohmann & Barnard, Hauppauge, NY www.h-b.com
 - b. Wire-Bond, Charlotte, NC
 - c. Manufacturer of comparable products meeting requirements of specifications.
- G. Masonry Accessories:
1. Weep Vents: Acceptable manufacturers, subject to compliance with requirements, are:
 - a. CavClear, Hudson, WI www.cavclear.com
 - b. Dur-O-Wal Cell Vent, Aurora, IL www.dur-o-wal.com
 - c. Hohmann & Barnard, Hauppauge, NY www.h-b.com
 - d. Manufacturer of comparable products meeting requirements of specifications.
 2. Cavity Drainage Material: Acceptable Manufacturers, subject to compliance with requirements, are:
 - a. CavClear, Hudson, WI www.cavclear.com
 - b. Mortar Net USA, LTD, Gary, IN www.mortarnet.com
 - c. Mortar Stop by Dur-O-Wall, Aurora, IL www.dur-o-wal.com
 - d. Manufacturer of comparable products meeting requirements of specifications.
 - e.
- H. Masonry Cleaner:
1. Standard of Quality: Design is based on products of ProSoCo, Inc., Lawrence, KS www.prosoco.com
 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Diedrich Technologies, Inc., Oak Creek, WI www.diedrichtechnologies.com
 - b. Manufacturer of comparable products meeting requirements of specifications.
 3. Gloss (Burnished Block) Sealer: Standard of Quality: Design is based on Tri Seal by TK Products, Minnetonka, MN www.tkproduct.com
 - a. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufactures and products are:
 - 1) BASF Building Systems, Shakopee, MN www.basfbuildingsystems.com
 - 2) Conspec, Kansas City, KS www.conspecmkt.com
 - 3) Prosoco, Lawrence, KS www.prosoco.com
 - b. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Portland Cement: ASTM C150, Type I.
- B. Lime: ASTM C207, Type S.
- C. Mortar Cement: ASTM C1329. Contractor has option of using pre-mixed mortar indicated below.
 - 1. Comply with ASTM C270 for types of mortar indicated below.
 - a. At or below grade: Type S.
 - b. Above grade: Type N, except as noted.
- D. Pre-Mixed Mortar:
 - 1. Meet ASTM C1142.
 - 2. Preblended, dry mortar mix
 - 3. Measure by weight to ensure accurate proportions.
 - 4. Thoroughly blend ingredients before delivering to Site.
- E. Grout Design Mix:
 - 1. ASTM C476.
 - 2. Minimum Compressive Strength: 3000 psi at 28 days.
 - 3. Mix Proportion: 1 part portland cement, 2 1/2 parts sand, 1 1/2 parts pea gravel, and adequate water to produce a concrete of approximate 10-inch slump.
- F. Masonry Cement: ASTM C91.
- G. Aggregate:
 - 1. Mortar: ASTM C144, natural or manufactured sand.
 - 2. Grout: ASTM C404, natural or manufactured sand, gravel, crushed stone, or slag.
- H. Water: Clean and free of oils, acids, alkalis, salts, organic materials, or other substances in amounts that may be harmful to mortar, grout, or embedded metals.
- I. Admixtures:
 - 1. Do not use air-entraining admixtures or materials containing air-entraining admixtures.
 - 2. Do not add set-retarding or set-accelerating, bond modifying, or corrosion-inhibiting admixtures to mortar or grout without written approval of architect.
 - 3. Do not use chloride or products containing chloride in mortar or grout in which metal reinforcement or accessories will be embedded.
 - 4. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

5. Water-Repellent Admixture: Intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
 - a. Product: Rheopel Plus Mortar Admixture, Euclid Chemical Company, or approved equal.

2.03 MANUFACTURED UNITS

A. Concrete Veneer Brick (Brick-1):

1. General Requirements:
 - a. Concrete veneer face brick manufactured with integral water repellent admixture.
 - b. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.
 - c. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing, or where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - d. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
2. Brick Schedule:
 - a. Brick Type-1 (Brick-1)
 - 1) Brick size: Utility (nominal 4 inches by 4 inches by 12 inches)
 - 2) Brick collection: Heritage Collection, Blended.
 - 3) Brick color: Tuscan Villa Blend.

B. Concrete Masonry Unit:

1. Provide exterior CMU with integral water repellent admixtures.
2. Modular, hollow and solid load-bearing standard weight.
3. Conforming to ASTM Standard C90, Type I, Grade N.
4. Corner blocks, jamb units, bond beam units, and special sizes and shapes as indicated or otherwise required.
5. Defects:
 - a. Exposed common CMU: Limited to 1/2 inch diameter defect in no more than 5 percent of the block. 2 defects maximum per block.
 - b. Burnished CMU: Limited to 3/8 inch-diameter in no more than 5 percent of Block. One defect maximum per block.
6. Block Types (normal weight unless otherwise specified):
 - a. Block Type-1 (CMU-1):
 - 1) Nominal block size: 8 inch by 16 inch face.
 - 2) Face style: Common.
 - 3) Block color: Natural gray
 - b. Block Type-2 (CMU-2):
 - 1) Nominal block size: 8 inch by 16 inch face.
 - 2) Face style: Burnished.
 - 3) Unscored.
 - 4) Block color: #253 River Rock by Amcon Block.

- c. Block Type-3 (CMU-3):
 - 1) Nominal block size: As noted on drawings.
 - 2) Face style: Smooth ultra-fine finish.
 - 3) Manufactured with integral water repellent admixture.
 - 4) Product: Mammoth Stone Series by Amcon Block and Precast Company or approved equal.
 - 5) Block color: #754 Glacial White.
- d. Block Type-4 (CMU-4):
 - 1) Nominal block size: 8 inch by 16 inch face.
 - 2) Face style: Split Face.
 - 3) Block color: #535 Ivory.

2.04 REINFORCEMENT

- A. Reinforcing Steel:
 - 1. Reinforcing Bars:
 - a. Uncoated deformed steel, ASTM A615, Grade 60.
- B. Joint Reinforcement:
 - 1. Meet ASTM A951.
 - 2. Prefabricated welded-wire units with deformed continuous side rods and plain cross rods, straight lengths of not less than 10'-0", with prefabricated corner and tee units.
 - 3. Width: Approximately 2 inches less than nominal width of walls and partitions.
 - 4. Mortar coverage: Minimum 5/8 inch on joint faces exposed to exterior and 1/2 inch elsewhere.
 - 5. Steel Wire Size:
 - a. Standard: 9 gage side and cross rods.
- C. Finishes:
 - 1. Interior Walls: Mill galvanized or hot dip.
 - 2. Exterior Walls, Foundations: Class B2 Hot Dipped Galvanized carbon.
- D. Design:
 - 1. Single-Wythe Masonry: Truss or ladder type with single pair of side rods and continuous diagonal cross rods spaced not more than 16 inches on center.
 - 2. Multi-Wythe Masonry: Truss design (composite construction), ladder design (cavity construction) with diagonal cross rods spaced not more than 16 inches on center; number of side rods as follows:
 - a. Composite construction: One for each face shell of concrete masonry back-up and 1 for brick wythe.
 - b. Multiple-wythe concrete masonry: One for each face shell of concrete masonry back-up and of concrete masonry facing wythe.
 - c. Multiple-wythe of differing materials or where horizontal joints of facing wythe do not align with those of back-up: Use units with adjustable 2 piece rectangular ties.

2.05 TIES AND ANCHORS

- A. Structural Back-up Types:
 - 1. Concrete Block (Cavity Wall): See joint reinforcement.
 - 2. Corrugated ties or anchors: Not allowed.
- B. Finishes:
 - 1. Wire Ties or Anchors; Exterior Walls/ Cavity Walls/Foundations; Completely Embedded in Mortar or Grout: Mill galvanized ASTM A641 Class 3 (0.80 ounce per square foot).
 - 2. Wire Ties or Anchors; Exterior walls/ Foundations; Not Completely Embedded in Mortar or Grout: Hot dipped galvanized ASTM A153 Class 2 (1.50 ounces per square foot); prime following welded fabrication.
 - 3. Sheet Metal Ties or Anchors; Exposed to Weather or Earth; or Completely Embedded in Mortar or Grout: Hot dipped galvanized ASTM A153 Class 2 (1.50 ounces per square foot); prime following welded fabrication.
- C. Anchor Bolts:
 - 1. Steel bolts with hex nuts and flat washers.
 - 2. Carbon: ASTM A307, Grade A
 - a. Hot-dip galvanized, Class C.
 - b. In sizes and configurations indicated.
- D. Shelf Angle Anchors: Unit type masonry inserts in concrete: cast iron or malleable iron inserts of type and size indicated.
- E. Post-installed Anchors: Chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in concrete, per ASTM E488 testing by qualified testing agency.
 - 1. Corrosion Protection:
 - a. Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5 for Class SC 1 service condition (mild).
 - b. Stainless-steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.
 - 1) Bolts and nuts ASTM F738 and ASTM F836.
 - 2) Anchors: ASTM A666 or ASTM A276 304 or 316.

2.06 INSULATION

- A. Rigid Cavity Wall Insulation (extruded polystyrene):
 - 1. See section 07 21 00 for insulation required insulation properties.
 - 2. Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by expansion of polystyrene base resin in extrusion process complying with ASTM C578, type IV.
 - 3. Thermal Value: 5-year aged R-values of 5.4 and 5 at 40 and 75 degrees F respectively.
 - 4. Preformed Units: To fit applications indicated, selected from manufacturer's standard thicknesses, widths, lengths.

5. Thickness: As indicated on Drawings, or if not indicated, thickness required to achieve R-10.
 6. Adhesive: Include manufacturer's recommended adhesive or other fasteners to make positive attachment to inner wythe or concrete masonry unit.
- B. Spray Foam Sealant: Non-shrink closed cell expanding urethane.

2.07 EMBEDDED MEMBRANE FLASHINGS

- A. Rubberized Asphalt Sheet Flashing:
1. Self-sealing, self-healing, fully adhering composite flexible flashing, consisting of pliable, highly adhesive, rubberized asphalt, bonded completely and integrally to multiple plies of 8 mil (minimum) high density cross laminated polyethylene film, 40 mil thick total (minimum), protected by release sheet.
 2. Include primer, surface conditioner, mastic, and other accessories as recommended by manufacturer.
 3. Sheet Metal Flashing and Cavity Bridge:
 - a. 24-gage prefinished steel hemmed.
 - b. Use to ensure rubberized asphalt sheet flashing will not bow and collect water.
- B. Stainless Steel Drip Plates: ASTM A666, 300, 20-gage custom fabricated of size as shown on Drawings, or prefabricated by manufacturer.
- C. Miscellaneous Flashing Accessories: Flashing pans, end dams, flashing corners, adhesives, primers, and seam tapes: Use flashing manufacturer's standard products or products recommended by flashing manufacturer.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

- A. Termination Bars: 304 stainless steel.
- B. Compressible Filler, Non-metallic Expansion Joint Strips:
1. Premolded, flexible cellular neoprene rubber filler strips.
 2. ASTM D1056, Grade 2A1.
 3. Capable of compression up to 35 percent of width and thickness indicated.
- C. Premolded Control Joint Gaskets:
1. Designed to fit standard sash block and to maintain lateral stability in masonry wall.
 2. Size and configuration as indicated.
- D. Bond Breaker Strips:
1. Asphalt-saturated organic roofing felt.
 2. ASTM D226, Type I, (No. 15 asphalt felt).

- E. Mortar Nets: Lightweight polyethylene or nylon net (90 percent open woven mesh), allowing water to flow through mortar droppings.
- F. Weep Vents:
 - 1. Plastic Weep Hole/Vent:
 - a. One-piece, flexible extrusion manufactured from ultraviolet-resistant polypropylene, medium density.
 - b. Designed to weep moisture in masonry cavity to exterior.
 - c. Sized to fill head joints with outside face held back from exterior face of masonry.
 - d. Color: Selected from manufacturer's standard.
- G. Pressure Treated Wood Blocking: See Section 06 10 00.
- H. Isolation Sheet: 4 mil polyethylene; use to separate incompatible metals from direct contact.
- I. Masonry Cleaners:
 - 1. Job site mixed muriatic acid is specifically prohibited.
 - 2. Verify cleaning agents are compatible with masonry materials prior to application. Obtain masonry manufacturer's approval before using cleaning agents.
 - 3. Proprietary Acidic Cleaner:
 - a. Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.
 - b. For burnished and rock face masonry units use Sure-Klean Burnished Masonry Cleaner.
 - c. For smooth face (mammoth stone) and concrete brick masonry surfaces use Sure-Klean Light Duty Concrete Cleaner or Vana-Trol.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect, with installer present, and verify that work is complete to point where this installation may properly commence. Examine surfaces that will support masonry work to ensure completion to proper lines and grades.
- B. Verification of Conditions: Verify that unit masonry systems may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.

- C. Discrepancies:
 - 1. Immediately notify architect.
 - 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 3. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection of Work:
 - 1. During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover minimum 24 inches down both sides and hold securely in place.
 - 2. Masonry to be exposed or painted: Prevent grout, mortar or soil from staining face. Immediately remove grout or mortar in contact with such masonry.
 - 3. Base of walls: Protect from rain-splashed mud, mortar splatter by spreading coverings on ground and over wall surface.
 - 4. Sills, ledges, projections: Protect from droppings of mortar.
- B. Cleaning Reinforcing: Before placing, remove loose rust, ice, other coatings from reinforcing.

3.03 INSTALLATION, GENERAL

- A. Procedures:
 - 1. Cavity and composite walls, and other masonry construction: Build to full thickness shown.
 - 2. Single-wythe walls: Build to actual thickness of masonry units, using units of nominal thickness indicated.
 - 3. Chases and recesses: Build as shown or required for work of other trades, with at least 8 inches of masonry between chase or recess and jamb of openings, between adjacent chases, recesses.
 - 4. Use bullnose masonry at corners, jambs, and window sills unless detailed otherwise.
 - 5. Leave openings for equipment to be installed before completion of masonry work.
 - 6. After installation of equipment, complete masonry work to match work immediately adjacent to opening.
- B. Cutting:
 - 1. Use motor-driven saws to provide clean, sharp, unchipped edges.
 - 2. Cut to provide continuous pattern and to fit adjoining work.
 - 3. Use full-size units without cutting where possible.
 - 4. Use dry cutting saws to cut concrete masonry units.

3.04 LAYING MASONRY UNITS

A. General:

1. Do not install masonry units that are cracked, broken, or chipped in excess of ASTM allowances.
2. When possible, orient units so that small chips and cracks are not on exposed side of wall.
3. Align unit cells or cores that are to be grouted.
4. Place units in final position while mortar is soft and plastic.
5. Match approved mock-up panel to provide uniform color blending in walls of exposed brick or CMU and to avoid patchy effect.

B. Layout and Tolerances:

1. Layout in advance for accurate spacing of surface bond patterns with uniform joint widths, accurate location of openings, movement-type joints, returns, and offsets.
2. Avoid use of less- than-half-size units at corners, jambs, and wherever possible at other locations.
3. Comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.
4. Install masonry to distance from adjoining dissimilar materials as detailed or if not detailed, 3/4 inch maximum.

C. Pattern Bond:

1. Match patterns as indicated. If not shown, lay in running bond with vertical joint in each course centered on units in courses above and below.
2. Do not use units with less than nominal 4-inch horizontal face dimensions at corners, jambs.

D. Stopping and Resuming Work:

1. Rake back 1/2-unit length in each course; do not tooth.
2. Clean exposed surfaces of set masonry, wet units lightly (if required), remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-in Work:

1. As work progresses, build-in items specified under this and other sections of these specifications.
2. Coordinate with any other trades involved.
3. Install all metal frames, bolts, inserts, sleeves, bearing plates, and other items required to be set in masonry.
4. Fill all hollow metal frames with concrete unless indicated otherwise. Rake out joint between frame and concrete masonry unit to create 3/8-inch reveal.
5. Fill in solidly with masonry around built-in items.
6. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
7. Built-in items to be embedded in cores of hollow masonry units: Place layer of metal lath in joint below, rod mortar or grout into core.

8. Embed anchors and ties at least 1/2 inch in mortar of outer face shell of hollow units and 1-1/2 inch in mortar of solid masonry.
9. Hollow concrete masonry units: Fill cores with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
10. Do not disturb or bend ties or anchors after embedding in grout or mortar.

3.05 BEDDING AND JOINTING

A. Mortar Mixing:

1. Mix mortar according to the requirements of ASTM C270.
2. Control batching procedure to ensure proper proportions by measuring materials by volume or weight as specified.
3. Control amount of mixing water and mortar consistency.
4. Discard mortar or grout that has partially set or is not used within 1-1/2 hours of mixing.
5. Re-temper with 1-1/2 hours of mixing to replace moisture lost by evaporation. Do not retemper colored mortars.

B. Solid Brick Masonry Units:

1. Lay with completely filled bed and head joint.
2. Butter ends with sufficient mortar to fill head joints, shove into place.
3. Do not slush head joints.
4. Back bevel bed joints to minimize mortar droppings in cavity.

C. Hollow Concrete Masonry Units:

1. Lay full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
3. For starting course on footings where cells are grouted, spread out full mortar bed including areas under cells.

D. Joints:

1. Joint widths: Maintain as shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8 inch joints.
2. Masonry walls to be concealed or covered by other materials: Cut flush unless otherwise indicated.
3. Exposed joints: Tool brick or concrete masonry joint slightly concave using jointer larger than joint thickness, unless otherwise indicated.

E. Masonry Units Disturbed After Laying:

1. Clean, reset in fresh mortar.
2. Do not pound corners of jambs to shift adjacent stretcher units that have been set in position.
3. If adjustment required, remove units, clean off mortar, reset in fresh mortar.

3.06 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

- A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes, not more than 16 inches on center vertically.
- B. Corners: Interlocking masonry unit bond in each wythe and course, unless otherwise shown.
 - 1. Horizontal Joints:
 - a. Horizontally reinforced masonry: Prefabricated “L” units, in addition to masonry bonding.
 - b. Intersecting and abutting walls: Unless vertical expansion or control joints shown at juncture, horizontal joint reinforcement using prefabricated “T” units.
 - 2. Vertical Joints:
 - a. Intersecting load-bearing walls carried up separately: Block or tooth vertical joint with 8 inches maximum offsets, rigid steel anchors spaced not more than 4 feet on center vertically; or omit blocking, provide rigid steel anchors at not more than 2 feet on center vertically.
 - b. Anchors: Form of galvanized steel not less than 1-1/2 inches by 1/4 inch by 2 feet long, ends turned up not less than 2 inches or with cross-pins. If used with hollow masonry units, embed ends in mortar-filled cores.

3.07 NON-BEARING INTERIOR PARTITIONS

- A. Height: Build to underside of structure or roof structure above, unless otherwise shown.
- B. Install with steel angles leaving a gap between top of wall and deck.
- C. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
- D. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 00.

3.08 CONSTRUCTION OF CAVITY WALLS

- A. Lay to dimensions and details shown, minimum 1 inch, clear and free of mortar bulges, droppings from top to bottom. Lay in bonds specified.
- B. Side Mortar Joint: Bevel to minimize mortar bulges or use clean-out strip to remove droppings and bulges from cavity. Spread mortar protruding into cavity on back of masonry units immediately following laying.
- C. Air Barrier Membrane: Coordinate with section 07 27 00.

- D. Weep Vents: Install as indicated on Drawings to allow equalization of air pressure in the cavity and to ventilate the cavity. If not indicated on Drawings, install at bottom above embedded flashing and top of wall, 16 inches on center.
- E. Weep Holes:
 - 1. Where weep vent is not appropriate, with approval of architect, parge bottom of cavity with mortar, provide weep holes 16 inches on center.
 - 2. Fill with cotton cord rope, attached minimum of 12 inches above flashing. For sills, fasten to highest point of installation.
 - 3. Attach wick vertically to insulation.
 - 4. Keep clear of mortar, other obstructions throughout construction process.
- F. Cavity Drainage Material: Install in bottom of cavity as indicated on Drawings to allow seepage of water in cavity to weeps.
- G. Foundation/Cavity Insulation:
 - 1. Securely attach to masonry wythe as shown on drawings with ties or adhesives specifically recommended by insulation manufacturer.
 - 2. Cut to fit around pipes, conduit, reinforcing, etc., using sharp knife, saws, drills as required.
 - 3. Use spray foam sealant at joints between rigid insulation sheets and at opening to provide complete seal.

3.09 REINFORCED MASONRY

- A. Set reinforcing bars in grout; do not use mortar.

3.10 HORIZONTAL JOINT REINFORCEMENT

- A. Continuous Horizontal Joint Reinforcement as Indicated:
 - 1. Longitudinal side rods in mortar for entire length with minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere.
 - 2. Lap reinforcing minimum 6 inches.
 - 3. Cut or interrupt at control and expansion joints, unless otherwise indicated.
 - 4. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.
 - 5. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections.
 - 6. Cut, bend reinforcement units as directed by manufacturer for continuity at returns, offsets, , pipe enclosures, other special conditions.
 - 7. Space continuous horizontal reinforcement as follows:
 - a. Multi-wythe walls where continuous horizontal reinforcement acts as structural bond or tie between wythes: As required by code but not more than 16 inches on center vertically.
 - b. Single-wythe walls: 16 inches on center vertically, unless otherwise indicated.

- B. Reinforcement at Openings:
 - 1. Reinforce masonry openings greater than 1 foot wide with horizontal joint reinforcement placed in 2 joints approximately 8 inches apart, immediately above lintel and immediately below sill.
 - 2. Extend minimum 2 feet beyond jambs of opening except at control joints.

3.11 CONTROL AND EXPANSION JOINTS

- A. Vertical and horizontal expansion, control, isolation joints in masonry where shown must be unobstructed by structure, mortar, or reinforcing. Build-in related items as masonry work progresses.
 - 1. Space joints as indicated on Drawings, or if not indicated 24 feet (maximum) on center. Verify location in writing with architect.
 - 2. Offset control joints in wythes of dissimilar materials.

3.12 ANCHORING MASONRY WORK

- A. Anchor devices of type indicated to structural members where masonry abuts or faces structural members, to comply with following:
 - 1. Open space not less than 1 inch width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 - 2. Flexible anchors embedded in masonry joints and attached to structure.
 - 3. Space as indicated, but not more than 16 inches on center vertically, 16 inches on center horizontally.

3.13 LINTELS

- A. Steel Lintels: Install where indicated.
- B. Masonry Lintels:
 - 1. Prefabricated or built-in-place from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.
 - 2. Where shown and wherever openings of more than 12 inches for brick size units and 24 inches for block size units are shown without structural steel or other supporting lintels.
 - 3. Cure before handling and installing.
 - 4. Temporarily support built-in-place lintels until cured.
- C. Hollow Concrete Masonry Unit Walls:
 - 1. Specially formed U-shaped lintel units, reinforcement bars placed as shown, filled with concrete.
 - 2. Match CMU in color, texture, and compressive strength.
 - 3. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.14 FLASHING OF MASONRY WORK

- A. Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges, and other obstructions to divert water to exterior.
- B. Location of Cavity Wall Base Flashing:
 - 1. The line of flashing and weep assemblies at the bottom of all cavity walls must occur above grade, sidewalks, or adjacent construction to allow proper drainage.
 - 2. Adjust elevation as required.
- C. Preparation: Prepare masonry surfaces smooth and free from projections which could puncture flashing.
- D. Extent of Flashing: Full length of lintels and shelf angles, minimum of 4 inches into masonry each end. Extend 1 inch from outer edge of drip plate at exterior face of outer wythe of masonry through outer wythe, turned up minimum 12 inches and fasten to exterior face of inner wythe with termination bar and mastic.
 - 1. At heads and sills turn up ends not less than 2 inches to form a pan.
 - 2. Interlock end joints of deformed metal flashings by over-lapping deformations at least 1-1/2 inches, seal lap with elastic sealant.
 - 3. Support all sheet flashings.
 - 4. Ensure positive drainage with use of sheet metal cavity bridges as required.
- E. Installation of Flashing: Comply with Drawings using only adhesives and materials specifically recommended.
 - 1. Form flashing to correct profile without wrinkles or buckles, and protect from punctures and tears during installation.
 - 2. Press flashing firmly in place using steel roller.
 - 3. Apply mastic at top edge, laps, and seams.
 - 4. Install metal drip plate at all locations of flashing.
 - 5. Place through-wall flashing on sloping bed of mortar.
 - 6. Seal penetrations in flashing with mastic before covering with mortar.
 - 7. Set drip plate in bed of mastic.
 - 8. Lap embedded flashing over top of drip plate but not exposed.
 - 9. Construct end dams by turning up the flashing at ends to prevent spillage.
 - 10. Fold flashing. Do not cut.
 - 11. Cover embedded flashing with mortar.
 - 12. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.
 - 13. Provide expansion joints in metal flashing.

3.15 ADJUSTING

- A. Remove damaged masonry units and units that do not match adjoining units as intended. Replace with new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.

- B. Pointing: During tooling of joints, enlarge voids or holes, except weep holes, and completely fill with mortar. Point-up joints including corners, openings, and adjacent work to provide a neat, uniform appearance, prepared for application of sealants. Tuck point and repair cracks or nail holes 1/32 of an inch or larger.
- C. Shoring and Bracing: Provide temporary support for masonry elements such as lintels, beams, arches, and soffits. Do not remove until masonry has cured sufficiently to carry its own weight and other temporary loads that may be placed on it during construction.

3.16 FIELD QUALITY CONTROL

- A. Site Tests: Comply with requirements of Section 01 45 10.
- B. Construction Tolerances:
 - 1. Variation from plumb: Do not exceed 1/4 inch in 10 feet, or 3/8 inch in a story height not to exceed 20 feet, or 1/2 inch maximum.
 - 2. Variation from level:
 - a. Bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, other conspicuous lines: Do not exceed 1/4 inch in 10 feet or 1/2 inch maximum.
 - b. Top surface of bearing walls: Do not exceed 1/4 inch in 10 feet or 1/2 inch maximum.
 - 3. True to a line: Do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. Variation in cross-sectional dimensions or elevations: Shall not exceed minus 1/4 inch, plus 1/2 inch.
 - 5. Alignment of columns and walls (bottom versus top):
 - a. Bearing walls: 1/2 inch.
 - b. Non-bearing walls: 3/4 inch.
 - 6. Grout space or cavity width: Minus 1/4 inch, plus 3/8 inch.
 - 7. Variation in mortar joint thickness:
 - a. Do not exceed bed joint thickness indicated by more than plus/minus 1/8 inch, with maximum thickness limited to 1/2 inch.
 - b. Do not exceed head or collar joint thickness indicated by more than minus 1/4 inch or plus 3/8 inch.

3.17 CLEANING

- A. Job site mixed muriatic acid is specifically prohibited.
- B. Dry brush masonry surfaces after mortar has set at end of each work day and after final pointing.
- C. Clean exposed, unglazed masonry with stiff brush and clean water, or with mild cleaning agent approved by architect and unit manufacturer.
- D. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

- E. Use masonry cleaning agents in strict accordance with manufacturers recommendations and instructions.
- F. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain architect's approval of sample cleaning before proceeding with cleaning of masonry.
- G. Protect adjacent surfaces from contact with cleaner by covering with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
- H. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

3.18 SURFACE TREATMENTS

- A. Sealing: Seal burnished concrete masonry work after curing with 1 coat of specified sealer applied in strict accordance with manufacturer's recommendations.

3.19 PROTECTION

- A. Provide final protection and maintain conditions in manner acceptable to installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.
- B. Uniform floor, roof loading: Do not apply for at least 12 hours after building masonry walls or columns.
- C. Concentrated loads: Do not apply for at least 3 days after building masonry walls or columns.

SECTION 04 43 00 - STONE MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Provide the following stone masonry materials for installation by section 04 20 00:
 - 1. Stone masonry anchored to concrete masonry backup.
 - 2. Stone fill for gabions.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete
 - 2. Section 04 20 00 - Unit Masonry Assemblies
 - 3. Section 05 50 00 – Metal Fabrication

1.02 REFERENCES

- A. ACI 530 - Code Requirements for Masonry Structures
- B. ASTM:
 - 1. C91 - Specifications for Masonry Cement
 - 2. C97 - Absorption and Bulk Specific Gravity of Dimension Stone
 - 3. C170 - Compressive Strength of Dimension Stone
 - 4. C568 - Limestone Dimension Stone

1.03 SUBMITTALS

- A. Provide submittals according to Division 01.
- B. Product Data:
 - 1. Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance and cleaning recommendations for each type of product indicated.
 - 2. For stone varieties proposed, include data on physical properties required by referenced ASTM standards.
- C. Shop Drawings: Indicate layout; pertinent dimensions; anchorages; reinforcement; head, jamb, and sill opening details; jointing methods; and cutting and setting.
- D. Samples:
 - 1. Color Verification:
 - a. Prior to shipping, submit each type of finish indicated; in sets for each color, texture, and pattern specified, showing a full range of variations expected in these characteristics. Include notification to architect if selection is not within quoted price range.
 - b. For each color of mortar required. Label samples to indicate types and amounts of pigments used.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide materials furnished from a single quarry with resources to provide materials of consistent quality in appearance and physical properties, for each different product required
- B. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters, and who has completed stone masonry projects similar in material, design, and extent to this Project.
- C. Field-Erected Mockups:
 - 1. Coordinate with section 04 20 00 for mockup construction.
 - 2. Provide stone masonry for mockup construction.
 - 3. Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.

4. Approval of mockups is for color, texture, and blending of stone; relationship of mortar and sealant colors to stone colors; tooling of joints; and aesthetic qualities of workmanship
 5. Build mock-up in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include stone coping at top of mockup.
 - b. Include a sealant-filled joint at least 16 inches long in mockup.
 - c. Include through-wall flashing installed for a 24-inch length in corner of mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit stone masonry above half of flashing).
 - d. Include studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.
 6. Protect accepted mockups from the elements with weather-resistant membrane.
 7. Accepted mock-up in undisturbed condition at time of Substantial Completion may become part of completed unit of work.
- D. Preinstallation Meetings: Conduct conference at Site to comply with requirements of Section 01 31 19.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo.
- B. Storage:
1. Stone:
 - a. Store on wood skids or pallets; cover with non-staining, waterproof membrane. Distribute weight evenly. Prevent breakage or cracking of stones. Store cementitious materials off ground, under cover, in dry location.
 - b. Lift with wide-belt type slings where possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required to move stone, use wood rollers with cushions at end of wood slides.
 - c. Protection: Protect from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stone.

1.06 PROJECT CONDITIONS

- A. Protection of Stone Masonry:
1. During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.
 2. Cover partially completed stone masonry when construction is not in progress.
 3. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone masonry.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
- C. Environmental Requirements:
 - 1. Cold-weather Requirements:
 - a. Do not use frozen materials or materials mixed or coated with ice or frost.
 - b. Do not build on frozen subgrade or setting beds.
 - c. Comply with cold-weather construction requirements contained in ACI 530.
 - d. Cold-weather cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and above and will remain so until masonry has dried.
 - 2. Hot-weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.
- D. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 COORDINATION

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

1.08 WARRANTY

- A. Provide warranty that Work shall be free from faults and defects in materials and workmanship for a period of 1 year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Stone:
 - 1. Standard of Quality: Unless indicated otherwise, design is based on products of Halquist Stone, Sussex, WI, www.halquiststone.com, Krukowski Stone (www.krukowskistone.com)

2. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. Manufacturer of comparable products meeting requirements of specifications.
 - b. Color and texture of stone masonry must be approved by architect prior to acceptance of alternate suppliers or products. Color and texture of stone shall be grounds for rejection of alternate materials and products.

2.02 MATERIAL

A. Mortar Materials

1. Portland Cement:
 - a. ASTM C150, Type I or II, except Type III may be used for cold-weather construction.
 - b. Provide natural color or white cement as required to produce mortar color indicated.
 - c. Low-alkali cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.
2. Hydrated Lime, Type S: ASTM C207
3. Portland Cement/Lime Mix: Packaged blend of portland cement complying with ASTM C150, Type I or III, and hydrated lime complying with ASTM C207.
4. Colored Cement:
 - a. Pigments shall not exceed 10 percent of portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
5. Masonry Cement: ASTM C91.
6. Mortar Cement: ASTM C1329.
 - a. For pigmented mortar, use a colored cement formulation as required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations.
 - b. Mortar pigments: Natural or synthetic iron oxides, compounded for use in mortar mixes and with a record of satisfactory performance in stone masonry mortars.
7. Aggregate:
 - a. ASTM C144.
 - b. Pointing: Use aggregate graded with 100 passing No. 16 sieve.
 - c. White aggregates: Natural white sand or ground white stone.
 - d. Colored aggregates: Natural-colored sand or ground marble, granite, or other sound stone, of color necessary to produce required mortar color.
8. Latex Additive: Manufacturer's standard, water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with field-mixed portland cement mortar bed, not containing a retarder.

9. Cold Weather Additive: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
10. Water: Potable.

2.03 COMPONENTS

A. Veneer Anchors:

1. Materials:
 - a. Hot-dip galvanized steel wire: ASTM A82, with ASTM A153, Class B-2.
 - b. Hot-dip galvanized steel sheet: ASTM A1008, cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A153, Class B-2.
 - c. Wire veneer anchors: Formed from W1.7 or 0.148-inch-diameter wire.
2. Adjustable Screw-Attached Veneer Anchors:
 - a. Units with triangular wire tie and rib-stiffened, sheet metal anchor section with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot for connection of wire tie.
 - b. 2-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to wall.
 - c. For attachment over sheathing to wood or metal studs.
 - d. Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch.

B. Embedded Flashing Materials

1. See section 04 20 00.

C. Insulation:

1. See section 04 20 00.

2.04 MISCELLANEOUS MASONRY ACCESSORIES

A. Joint Filler Strips:

1. Non-metallic, premolded, flexible joint filler strips.
 - a. ASTM D1056, Grade 2A1.
 - b. Capable of compression up to 35 percent of width and thickness indicated.
 - c. Compressible filler, designed to fit standard sash block and to maintain lateral stability in masonry wall.
 - d. Continuous, non bleeding material compatible with joint conditions.
2. Bond Breaker Strips: Asphalt-saturated inorganic roofing felt, ASTM D6757, Type I, (No. 15 asphalt felt).

- B. Weep Holes/Vent Products:
 - 1. See section 04 20 00.
- C. Pressure Treated Wood Blocking: See Section 06 10 00.
- D. Masonry Cleaners:
 - 1. See section 04 20 00.
- E. Other Materials: Materials not specifically described but required for complete, proper installation of stone masonry, subject to acceptance of architect.

2.05 MIXES

- A. Mortar:
 - 1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 2. Do not use calcium chloride.
 - 3. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 - 4. Add cold-weather admixture at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
 - 5. Comply with ASTM C270, Proportion Specification.
 - a. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 - b. Mortar for setting stone: Type N.
 - c. Mortar for pointing stone: Type N.
- B. Mixing Pointing Mortar:
 - 1. Thoroughly mix cementitious and aggregate materials together before adding water.
 - 2. Mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball.
 - 3. Maintain mortar in this dampened condition for one to two hours.
 - 4. Add remaining water in small portions until mortar reaches desired consistency.
 - 5. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- C. Preblended, Dry Mortar Mix:
 - 1. Furnish dry mortar ingredients in the form of a preblended mix.
 - 2. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Site.

2.06 FABRICATION

- A. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.
- B. Clean sawed backs of stone to remove rust stains and iron particles.
- C. Building Stone (full face veneer):
 - 1. Shape stone for type of masonry (pattern) as follows:
 - a. Finish: Split Face Finish.
 - b. Sawed-bed random ashlar:
 - 1) Course heights: Random.
 - 2) Width: 3-inches to 5-inches.
 - 3) Lengths:
 - a) Random.
 - b) 1-foot to 2-foot long pieces.
 - 2. Product:
 - a. Castle Stone Collection by Halquist Stone.
 - b. Color: Vanderbilt.
- D. Gabion Stone Fill:
 - 1. Provide stones matching color and texture of building stone.
 - 2. Stone shall be split on all sides, no smooth saw cut faces.
 - 3. Shapes:
 - a. Random sized stone varying from 4-inches to 6-inches in height, width and length.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
 - 1. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.
 - 2. Examine wall framing, sheathing, and weather-resistant sheathing paper to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.
- B. Verification of Conditions: Verify that stone veneer may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

- D. Discrepancies:
1. Immediately notify architect in writing.
 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 3. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Verify concrete masonry backup is fully prepared and ready for stone masonry installation.
- B. Clean dirty or stained stone surfaces before setting by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
- C. Cold Weather Preparation: Carefully apply heat to stone surface until dry to touch to remove ice or snow formed on stone or assembled stonework beds.

3.03 SETTING STONE MASONRY

- A. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- B. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- C. Arrange and trim stones for accurate fit as follows:
1. Range ashlar pattern, lengths and course heights as specified, uniform joint widths with offset between vertical joints.
- D. Set stone to comply with requirements indicated on Drawings.
1. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.
 2. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- E. Perform necessary field cutting as stone is set.
1. Use power saws or hydraulic guillotine splitter to cut stone.
 2. Cut lines straight and true, with edges eased slightly to prevent snapping.
 3. Use hammer and chisel to split stone that is fabricated with split surfaces.
 4. Match similar surfaces that were shop or quarry fabricated.
 5. Pitch face at field-split edges as needed to match stones that are not field split.
- F. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment, if any. Lay walls with joints not less than 1/4 inch at narrowest points nor more than 1/2 inch at widest points.

- G. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. See Section 07 92 00.
- H. Install embedded flashing and cavity vents at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, at the top of cavities such as undershelf angles, and where indicated.
 - 1. Coordinate with section 04 20 00.
 - 2. At concrete backing, extend flashing through stone masonry, turned up a minimum of 8 inches and insert in reglet.
 - 3. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
 - 4. At heads and sills, extend flashing 4 inches at ends and turn up not less than 2 inches to form a pan.
 - 5. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a drip.
 - 6. Install metal drip edges beneath flashing at exterior face of wall. Stop flashing 1/2 inch back from outside face of wall and adhere flashing to top of metal drip edge.
 - 7. Install metal flashing termination beneath flashing at exterior face of wall. Stop flashing 1/2 inch back from outside face of wall and adhere flashing to top of metal flashing termination.
 - 8. Cut flashing flush with face of wall after masonry wall construction is completed.
- I. Place weep vent/holes in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
 - 1. Coordinate with section 04 20 00.
 - 2. Use plastic vents to form weep holes.
 - 3. Space weep vents 24 inches on center
 - 4. Place cavity drainage material immediately above flashing in cavities.
 - 5. Install vents in vertical head joints at the top of each continuous cavity at 24 inches on center.
 - 6. Close cavities off vertically and horizontally with blocking in manner indicated.
 - 7. Install through-wall flashing and weep holes above horizontal blocking.

3.04 INSTALLATION

- A. Foundation/Cavity Insulation:
 - 1. Coordinate with section 04 20 00.
 - 2. Securely attach to interior masonry wythe with ties or adhesives specifically recommended by insulation manufacturer.
 - 3. Cut to fit around pipes, conduit, reinforcing, etc., using sharp knife, saws, drills as required.
 - 4. Use spray foam sealant at joints between rigid insulation sheets and at opening to provide complete seal.

- B. Anchoring:
1. Anchor stone veneer to unit masonry with metal veneer anchors as follows:
 - a. Embed corrugated-metal anchors in unit masonry mortar joints or grouted cells for distance at least one-half of veneer thickness.
 - b. Secure wire anchors by inserting pintles into eyes of masonry wall reinforcement projecting from horizontal mortar joints.
 - c. Connect anchors to masonry joint reinforcement with vertical rods inserted through anchors and through eyes of masonry wall reinforcement projecting from horizontal mortar joints.
 - d. Embed anchors in veneer mortar joints to within 1 inch of face.
 2. Anchor stone veneer to stud framing with adjustable, screw-attached veneer anchors as follows:
 - a. Fasten each anchor section through sheathing to framing with two screws.
 - b. Embed wire tie section in mortar joints to within 1-1/2 inches of face.
 3. Space veneer anchors not more than 16 inches on center vertically and 24 inches on center horizontally, with not less than 1 veneer anchor per 2.67 square feet of wall area.
 4. Install additional veneer anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
 5. Set stone in full bed of mortar with full head joints, unless otherwise indicated.
 6. Build veneer anchors into mortar joints as stone is set.
 7. Install continuous wire reinforcement in horizontal joints indicated and attach to seismic veneer anchors as stone is set.
- C. Provide 1 OR 2 inch cavity between stone masonry and backup construction unless otherwise indicated, keeping free of mortar droppings and debris.
1. Place mortar spots in cavity at veneer anchors to maintain spacing.
 2. Slope beds toward cavity to minimize mortar protrusions into cavity.
 3. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Treated Wood Blocking: Coordinate with Section 06 10 53 for installation of door and window blocking.

3.05 GABION INSTALLATION

- A. Fill steel framed gabion site structures with random shaped stones.
- B. Arrange stones in gabions to completely fill the structure with no large gaps or voids.

3.06 SITE TOLERANCES

- A. Variation from Plumb:
1. For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more.
 2. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

3. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
4. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 or more.

3.07 POINTING

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

3.08 ADJUSTING

- A. Remove and replace stone veneer assemblies of the following description:
 1. Broken, chipped, stained, or otherwise damaged.
 2. Defective joints.
 3. Not matching approved samples and mockups.
 4. Not complying with other requirements indicated.
- B. Replacement shall match approved work and show no evidence of replacement.

3.09 CLEANING

- A. Site:
 1. Do not allow accumulation of scraps or debris arising from Work of this Section.
 2. Maintain premises in neat, orderly condition.
- B. System:
 1. Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
 2. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - a. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - b. Use cleaning methods and agents approved in writing by stone supplier.

- c. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain architect's approval of sample cleaning before cleaning stone masonry.
- d. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
- e. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
- f. Clean stone masonry by bucket and brush hand-cleaning method using job-mixed detergent solution.

3.10 EXCESS MATERIALS AND WASTE

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

3.11 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer to ensure work is without damage or deterioration at time of Substantial Completion.

DIVISION 5 - METALS

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide structural steel:
 - 1. Columns.
 - 2. Beams.
 - 3. Shop priming.

4. Auxiliary materials:
 - a. Direct tension indicators.
 - b. Electrodes for welding.
 - c. Structural steel primer.
 - d. Cement Grout:
 - 1) Portland cement, sand.
 - e. Nonmetallic shrinkage-resistant grout:
 - 1) Premixed nonmetallic grouting compound, CE CRD-C621.
- B. Furnish the following for other sections to install, including but not limited to:
 1. Embedments:
 - a. Anchor bolts.
- C. Perform the following:
 1. Touch-up primer paint.
- D. The following is not included:
 1. Lintels not attached to the structural steel frame.
- E. Related Sections:
 1. Section 03 30 00 - Cast-in-Place Concrete
 2. Section 04 20 00 - Unit Masonry Assemblies
 3. Section 09 91 50 - Shop Painting
- F. Alternates: Refer to Section 01 23 00.
- G. Unit Prices: Refer to Section 01 27 00.

1.02 REFERENCES

- A. AISC:
 1. Code of Standard Practice for Steel Buildings and Bridges
 2. Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings, including Commentary” and Supplements
 3. Specifications for Structural Joints using ASTM A325 or A490 Bolts, approved by Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation
- B. ASTM:
 1. A6 - General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
 2. A36 - Carbon Structural Steel
 3. A53 - Pipe, Steel, Black, Hot Dipped, Zinc Coated, Welded, Seamless
 4. A148 - High Strength Steel Castings, Carbon, Structural
 5. A307 - Carbon Steel Bolts and Studs
 6. A325 - Structural Bolts, Steel, Heat Treated
 7. A490 - Structural Bolts, Alloy Steel, Heat Treated

8. A500 - Cold-Formed, Welded and Seamless Carbon Steel Structural Tubing
9. A501 - Hot-Formed, Welded and Seamless Carbon Steel Structural Tubing
10. A992 - Structural Steel Shapes

- C. AWS:
1. D1.1 - Structural Welding Code
 2. Standard Qualification Procedure

1.03 DEFINITIONS

- A. Structural Steel Lintels: Lintels are included with structural steel only if attached to the structural steel frame.

1.04 SYSTEM DESCRIPTION

- A. Performance Requirements:
1. Connections: Provide details of connections to withstand loads indicated and comply with other information and restrictions indicated.
 2. Select and complete connections using AISC's Manual of Steel Construction: Load and Resistance Factor Design; Allowable Stress Design.
 3. Construction:
 - a. Simple.

1.05 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Product Data: Producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports, other data to show compliance with specifications (including specified standards):
1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
 2. High-strength bolts (each type), including nuts and washers.
 3. Structural steel primer paint.
- C. Shop Drawings:
1. Prepare under supervision of Professional Engineer, registered in the state in which Project is located.
 2. Include complete details, schedules for fabrication, assembly of structural steel members procedures and diagrams; details of cuts, connections, camber, holes, other data.
 3. Indicate welds by standard AWS symbols; show size, length, and type of weld.
 4. Provide setting drawings, templates, directions for installation of anchor bolts, other anchorages to be installed by others.

1.06 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Comply with referenced standards, except as otherwise indicated.
 - 2. Delete the following sentence of Paragraph 4.2.1 - Code of Standard Practice for Steel Buildings and Bridges: “This approval constitutes owner’s acceptance of all responsibility for design adequacy of any connections designed by fabricator as a part of preparation of these Shop Drawings.”
- B. Conflicting Requirements: More stringent shall govern.
- C. Qualifications for Welding Work:
 - 1. Qualify welding processes, operators according to AWS “Standard Qualification Procedure”.
 - 2. Provide certification that welders have satisfactorily passed AWS qualification tests.
 - 3. If recertification of welders required, retesting will be contractor’s responsibility.
- D. Surveys:
 - 1. Owner may employ services of registered Professional Engineer or land surveyor to verify tolerance compliance.
 - 2. If out of compliance, contractor responsible for payment.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Ensure uninterrupted progress of work.
- B. Storage:
 - 1. Permit easy access for inspection and identification.
 - 2. Keep steel members off ground, using pallets, platforms, or other supports.
- C. Protection:
 - 1. Protect steel members, packaged materials from erosion and deterioration.
 - 2. Do not store materials on structure in manner that might cause distortion or damage to members or supporting structures.
- D. Damaged Materials or Structures: Repair or replace as directed.

1.08 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
1. Non-shrink Metallic Grouts:
 - a. Metox RM by ChemMasters Corporation www.chemmasters.net
 - b. Hi-Flow Metallic Grout by Euclid Chemical Company www.euclidchemical.com
 - c. Embeco 636 by BASF www.basfbuildingsystems.com
 2. Non-shrink Nonmetallic Grouts:
 - a. Bonsal Construction Grout by W. R. Bonsal Company www.bonsal.com
 - b. Hi-Flow Grout by Euclid Chemical Company www.euclidchemical.com
 - c. Kemset by ChemMasters Corporation www.chemmasters.net
 - d. Crystex by L & M Construction Chemicals, Inc www.lmcc.com
 - e. Masterflow 713 by Unicon of BASF www.unicon.ca
 - f. SonogROUT by BASF www.basfbuildingsystems.com
 3. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 MATERIALS

- A. General:
1. Materials to be smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness.
 2. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes.
- B. Wide Flange Shapes and Structural Tees cut from: ASTM 992.
- C. Steel Pipe: ASTM A53, Grade B.
- D. Cold-form Steel Tubing: ASTM A500, Grade B.
- E. Hot-formed Steel Tubing: ASTM A501.
- F. All Other Structural Steel Shapes, Plates, and Bars: ASTM A36.
- G. Anchor Bolts: ASTM A307, non-headed type unless otherwise indicated.
- H. Epoxy Adhesive Anchors:
1. Hilti: HY 150 Injection Adhesive Anchors, Hilti HVA Adhesive Anchor, Hilti HIT 20 Masonry Anchor, Sika, or approved equal.
 2. If the embedment length is not shown on the Drawings, provide the embedment length recommended by the manufacturer to develop the full allowance strength of the bolt.

- I. Unfinished Threaded Fasteners:
 - 1. ASTM A307, Grade A.
 - 2. Regular low-carbon steel bolts and nuts.
 - 3. Provide hexagonal heads and nuts for all connections.
- J. High-strength Threaded Fasteners:
 - 1. Heavy hexagon structural bolts, heavy hexagon nuts, hardened washers.
 - 2. Quenched and tempered medium carbon steel bolts, nuts, and washers.
 - 3. Comply with ASTM A325.
 - 4. Direct tension indicator washers may be used.
- K. Electrodes for Welding: Comply with AWS.
- L. Non-shrink Metallic Grout: Premixed, factory-packaged, interior ferrous aggregate grout complying with CE CRD-C 621 only, specifically recommended by manufacturer for heavy duty loading applications of type specified in this section.
- M. Non-metallic Shrinkage-resistant Grout:
 - 1. Pre-mixed, non-metallic, non-corrosive, non-staining.
 - 2. Containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents.
 - 3. Comply with CRD C621.
 - 4. Subject to compliance with requirements, products may include, but are not limited to:
 - a. Euco N.S.; Euclid Chemical Co.
 - b. Crystex; L&M Construction
 - c. Chemicals Masterflow 713; Master Builders
 - d. Upcon; Upco Chemical Division, USM Corporation.

2.03 FABRICATION

- A. Shop Fabrication and Assembly:
 - 1. Fabricate and assemble structural assemblies in shop to greatest extent possible according to AISC Specifications and as indicated on final Shop Drawings.
 - 2. Provide camber in structural members where indicated.
 - 3. Where finishing is required, complete assembly, including welding of units, before start of finishing operations.
 - 4. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- B. Marking and Delivery:
 - 1. Mark and match-mark materials for field assembly.
 - 2. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

- C. Connections:
 - 1. Shop connections: Weld or bolt as indicated.
 - 2. Field connections: Bolt, except where welded connections or other connections are indicated.
 - 3. Principal bolted connections: Provide high-strength threaded fasteners except where unfinished bolts are indicated.
 - 4. Bolted connections of secondary framing members to primary members. Provide unfinished threaded fasteners
 - 5. Temporary bracing: Provide unfinished threaded fasteners.
- D. High-Strength Bolted Construction:
 - 1. Install according to AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts."
- E. Welded Construction: Comply with AWS Code for procedures, appearance, quality of welds, and methods used in correcting welding work.
- F. Holes for Other Work:
 - 1. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final Shop Drawings.
 - 2. Provide threaded nuts welded to framing, other specialty items as indicated to receive other work.
 - 3. Cut, drill, or punch holes perpendicular to metal surfaces.
 - 4. Do not flame cut holes or enlarge holes by burning.
 - 5. Drill holes in bearing plates.

2.04 SHOP PAINTING

- A. General Requirements:
 - 1. Shop paint structural steel, except:
 - a. Members or portions of members to be embedded in concrete or mortar.
 - b. Members to receive fireproofing.
 - c. Surfaces to be welded or high-strength bolted with friction-type connections.
 - 2. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.
 - 3. Apply 2 coats to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- B. Materials:
 - 1. Refer to Section 09 91 00.
 - 2. Members to receive fireproofing: Primer approved by fireproofing or intumescent paint manufacturer in compliance with UL or FM assemblies.
- C. Painted items shall be fully dry before handling or shipping.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that Structural Steel may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify Engineer. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection: Protect installed work and materials of other trades.

3.03 ERECTION

- A. Surveys:
 - 1. Employ registered Professional Engineer or land surveyor for accurate erection of structural steel if deemed necessary.
 - 2. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Engineer.
 - 3. Do not proceed with erection until corrections have been made, or compensating adjustments to structural steel work have been agreed upon with Engineer.
- B. Temporary Shoring and Bracing:
 - 1. Provide connections of sufficient strength to bear imposed loads. Remove when permanent members are in place and final connections are made.
 - 2. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Provide temporary planking and working platforms as necessary to effectively complete work.
- C. Anchor Bolts:
 - 1. Anchor bolts and other connectors: As required for securing structural steel to foundations and other in-place work.
 - 2. Templates and other devices: As necessary for presetting bolts and other anchors to accurate locations.
 - 3. Refer to Division 3 for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.

- D. Setting Bearing Plates:
1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
 2. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
 3. Tighten anchor bolts after supported members have been positioned and plumbed.
 4. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 5. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain.
 6. Finish exposed surfaces, protect installed materials, and allow to cure.
 7. Comply with grout manufacturer's instructions.
- E. Field Assembly:
1. General requirements: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevation and alignment.
 2. Level and plumb individual members of structure within specified AISC tolerances.
 3. Establish required leveling and plumbing measurements on mean operating temperature of structure. Allow for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
 4. Splice members only where indicated and accepted on Shop Drawings.
- F. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, grind smooth at exposed surfaces.
1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, removal of paint on surfaces adjacent to field welds.
 2. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- G. Gas Cutting:
1. Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing.
 2. Cutting permitted only on secondary members that are not under stress, as acceptable to Engineer.
 3. Finish gas-cut sections equal to sheared appearance when permitted.

3.04 REPAIR/RESTORATION

- A. Touch-up Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint.
 - 2. Apply paint to exposed areas using same material as used for shop painting, by brush or spray to provide minimum dry film thickness of 1.5 mils.
 - 3. Touch up marred finishes.
 - 4. Verify paint for areas to be fireproofed.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Comply with requirements of Section 01 45 10.

3.06 ADJUSTING

- A. Replace damaged materials with new materials complying with specified requirements.

3.07 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.
- B. Other Work:
 - 1. Remove temporary covering and other provisions made to minimize soiling of other work.
 - 2. Promptly clean surfaces soiled by this section, repair surfaces stained, marred or otherwise damaged during work.
- C. Structural Steel:
 - 1. Clean exposed surfaces of structural steel using materials and methods recommended by manufacturer.
 - 2. When work is completed, remove unused materials, containers, equipment, and debris.
 - 3. Collect offcuts and scrap and place in designated areas for recycling.

3.08 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer to ensure work is without damage or deterioration at time of Substantial Completion.

SECTION 05 31 00 - STEEL DECKING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Roof deck.
 - 2. Shop priming.
 - 3. Steel deck accessories including, but not limited to:
 - a. Shear connectors.
 - b. Metal cover plates.
 - c. Metal closure strip.
- B. Related Sections:
 - 1. Section 05 12 00 - Structural Steel Framing
 - 2. Section 05 50 00 - Metal Fabrications
 - 3. Section 06 10 00 – Rough Carpentry
 - 4. Section 07 53 23 - EPDM Membrane Roofing

1.02 REFERENCES

- A. Industry Standards:
 - 1. AISI - Specifications for the Design of Cold-Formed Steel Structural Members
 - 2. AWS D1.3 - Structural Welding Code - Sheet Steel
 - 3. SDI - Design Manual for Floor Decks and Roof Decks
- B. ASTM:
 - 1. A36 - Carbon Structural Steel
 - 2. A108 - Steel Bar, Carbon and Alloy, Cold-Finished
 - 3. A653 - Steel Sheet, Galvanized or Galvannealed by Hop Dip Process
 - 4. A570 - Roof Systems Assemblies Employing Steel Deck, Preformed Insulation, and Bituminous Built-up Roofing
 - 5. A780 - Repair of Damaged and Uncoated Areas of Galvanized Coatings
 - 6. A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy, Improved Formability, Solution-Hardened, and Bake Hardable
 - 7. E119 - Fire Tests of Building Construction Materials

1.03 SUBMITTALS

- A. Provide submittals according to requirements of Division 01.
- B. Product Data: Manufacturer's specifications, installation instructions for each type of decking and accessories. Include manufacturer's certification to show compliance with Specifications.

- C. Shop Drawings:
 - 1. Show system fabrication, installation drawings, including plans, elevations, sections details of components, joint locations and configurations within system and between system and adjoining system.
 - 2. Show layout and types of deck panels, anchorage details, conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories.
- D. Certificates: Provide AWS D1.1 certification for welders.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of referenced standards.
- B. Field Welding: Qualify welding processes and welding operators according to procedures of AWS D1.3.
- C. Underwriters' Label:
 - 1. Fire Resistance: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory," with each deck unit bearing the UL label and marking for specific system detailed.
 - 2. Electrical Construction: Provide cellular floor deck units listed in UL "Electrical Construction Materials Directory" with each cellular metal floor deck unit bearing UL labels and marking. Provide units that will permit use of standard header ducts and outlets for electrical distribution systems.
- D. FM Listing: Provide metal roof deck units that have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire rated construction.
- E. Experience:
 - 1. Manufacturer: 10 years experience in the manufacture of Steel Decking.
 - 2. Contractor: 3 years experience in the installation of Steel Decking.

1.05 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 METAL DECK

- A. Standard of Quality: Design is based on products of Vulcraft/Div. Nucor Corp.

- B. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - 1. United Steel Deck, Inc.
 - 2. Wheeling Corrugating Co.
 - 3. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Steel for Galvanized Metal Deck Units: ASTM A153, Grade A.
- B. Miscellaneous Steel Shapes: ASTM A36.
- C. Sheet Metal Accessories: ASTM A1008, commercial quality, galvanized.
- D. Galvanizing: ASTM A653, G60.
- E. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-F-21035 (Ships).

2.03 STEEL DECKING

- A. Roof Deck Units: Provide deck configurations complying with referenced SDI standard of metal thickness, depth, width as shown.
- B. Steel Decking Accessories:
 - 1. Shear Connectors: Headed stud type, ASTM A108, Grade 1015 or 1020, cold-finished carbon steel, with dimensions complying with AISC specifications.
 - 2. Metal Closure Strips:
 - a. Fabricate metal closure strips, for cell raceways and openings between decking and other construction.
 - b. Minimum 0.045 inch (18 gage) sheet steel.
 - c. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.
 - 3. Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.
- C. Shop Painting:
 - 1. Materials:
 - a. Typical: Red oxide primer with less than 100 parts per million of lead, mercury, cadmium or hexavalent chromium.
 - b. Surfaces to Receive Fireproofing: In addition to above, shop paint only with materials that are approved by the fireproofing manufacturer in compliance with UL or FM assemblies.
 - 2. Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before applying shop paint.
 - 3. Apply one shop coat of primer paint to steel joists and accessories by spray, dipping, or other method.

4. Provide minimum continuous dry paint film thickness of 0.50 mil.
5. Verify shop primer is compatible with field finishes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that Steel Decking may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. General Requirements: Install according to manufacturer's recommendations, final Shop Drawings, and as specified.
 1. Place on supporting steel framework, adjust to final position with ends accurately aligned, bearing on supporting members before being permanently fastened.
 2. Do not stretch or contract side lap interlocks.
 3. Place in straight alignment for entire length of run of cells, close alignment between cells at ends of abutting units.
 4. Place flat and square, secured to adjacent framing without warp, excessive deflection.
 5. Do not place on concrete supporting structure until concrete has cured and is dry.
 6. Coordinate and cooperate with structural steel erection in locating decking bundles to prevent overloading of structural members.
 7. Do not use floor deck units for storage or working platforms until permanently secured.
- B. Fastened Deck Units:
 1. Fasten roof deck units to steel supporting members by not less than 1/2 inch diameter fusion welds or elongated welds of equal strength, spaced not more than 12 inches on center at every support, or as indicated on Drawings, and at closer spacing where required for lateral force resistance.
 2. Secure deck to each supporting member in ribs where side laps occur. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance, quality of welds, methods used in correcting welding work. Use welding washers where recommended by deck manufacturer.

3. Mechanically fasten side laps of adjacent deck units between supports, at intervals not exceeding 36 inches on center, using self-tapping No. 8 or larger machine screws.
- C. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 pounds per square feet at eave overhang and 30 pounds per square feet for other roof areas.
- D. Cutting and Fitting: Cut and neatly fit around other work projecting through or adjacent to decking, as shown.
- E. Closure Strips: Provide at open uncovered ends and edges of roof decking, in voids between decking and other construction. Weld into position to provide complete decking installation.
- F. Touch-up Painting:
 1. Typical: After decking installation, wire brush, clean, paint scarred areas, welds, rust spots on top and bottom surfaces of decking units and supporting steel members.
 2. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.
 3. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.
 4. Surfaces to be Fireproofed: Verify type of paint to be used.

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 1. Loose bearing and leveling plates.
 2. Loose lintels.
 3. Shelf and relieving angles.
 4. Pipe bollards.
 5. Site gabion frames.
 5. Metal fabrication accessories including, but not limited to:
 - a. Rough hardware.
- B. Related Sections:
 1. Section 03 30 00 - Cast-in-Place Concrete
 2. Section 04 20 00 - Unit Masonry Assemblies
 3. Section 04 43 00 – Stone Masonry
 4. Section 05 12 00 - Structural Steel Framing
 5. Section 07 92 00 - Joint Sealants

1.02 REFERENCES

A. Building Codes:

1. International Building Code
2. Wisconsin State Building Code

C. ASTM:

1. A27 - Steel Carbon Castings, General Applications
2. A36 - Carbon Structural Steel
3. A47 - Ferritive Malleable Iron Castings
4. A48 - Gray Iron Castings
5. A53 - Pipe, Steel, Black, Hot Dipped, Zinc Coated, Welded, Seamless
6. A123 - Zinc Coatings on Iron and Steel Products
7. A153 - Zinc Coatings on Iron and Steel Hardware
8. A167 - Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strips
9. A500 - Cold-Formed, Welded and Seamless Carbon Steel Structural Tubing
10. A501 - Hot-Formed, Welded and Seamless Carbon Steel Structural Tubing
11. A510 - Wire Rods and Coarse Round Wire, Carbon Steel
12. A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
13. A536 - Ductile Iron Castings
14. A569 - Tables, Mess, Marine, Steel
15. A653 - Steel Sheet, Galvanized or Galvannealed by Hot Dip Process
16. A780 - Repair of Damaged Galvanized Coatings
17. A786 - Hot Rolled Carbon, Low Alloy, High Strength Low Alloy, and Alloy Steel Floor
18. A992 - Structural Steel Shapes
19. A1008 - Steel Sheet, Cold Rolled, Carbon, Structural High Strength, Low Alloy
20. B632 - Aluminum Alloy Rolled Tread Plates
21. E119 - Test Method for Fire Tests of Building Construction and Methods

D. AWS:

1. D1.1 - Structural Welding Code - Steel
2. D1.2 - Structural Welding Code - Aluminum
3. D1.3 - Structural Welding Code - Sheet Metal

E. NAAMM:

1. Metal Finishes Manual

F. SSPC:

1. PA1 - Paint Application Specification No. 1
2. SP3 - Power Tool Cleaning
3. SP6 - Commercial Blast Cleaning

1.03 DEFINITIONS

- A. Metal Fabrications: Items made from iron and steel shapes, plates, bars, strips, tubes, pipes, castings not part of structural steel or other metal systems specified elsewhere.

1.04 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Thermal Movement: Allow for thermal movement for exterior assemblies resulting from maximum 150 degree change in ambient temperature in design, fabrication, installation to prevent buckling, opening up of joints, over stressing of welds and fasteners.
 - 2. Base design calculations on actual surface temperatures of metals due to solar heat gain and nighttime sky heat loss.

1.05 SUBMITTALS

- A. Product Data: Data for products used, including paint products and grout.
- B. Shop Drawings:
 - 1. Detail fabrication, erection of each metal fabrication indicated. Include plans, elevations, sections, details of metal fabrications, their connections. Show anchorage and accessory items.
 - 2. Provide templates for anchors, bolts specified for installation under other sections.
- C. Samples:
 - 1. Two sets, representative of materials, finished products as requested by Engineer.
- D. Calculations:
 - 1. Where indicated to comply with certain design loadings, include structural computations, material properties, other information needed for structural analysis, signed and sealed by qualified professional engineer, registered in the state where project located, responsible for their preparation.
- E. Welder Certificates: Signed by contractor certifying that welders comply with specified requirements.
- F. Qualification Data: For firms and persons specified, to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of architects and owners, and other information specified.

1.06 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Fabricator: Firm experienced in successfully producing metal fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

2. Installer: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.
3. Welding Processes and Welding Operators:
 - a. Qualify according to AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel," and D1.2 "Structural Welding Code - Aluminum."
 - b. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.07 SITE CONDITIONS

- A. Field Measurements:
 1. Check actual locations of walls, other construction to which metal fabrications must fit, by accurate field measurements before fabrication.
 2. Show recorded measurements on final Shop Drawings.
 3. Coordinate fabrication schedule with construction progress to avoid delay of Work.
 4. Where field measurements cannot be made without delaying Work, guarantee dimensions, proceed with fabrication without field measurements.
 5. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Grout and Anchoring Cement:
 1. Approved Manufacturers: One of the following or approved in advance by Engineer.
 2. Non-shrink Metallic Grouts:
 - a. Metox RM by ChemMasters Corporation www.chemmasters.net
 - b. Hi-Flow Metallic Grout by Euclid Chemical Company www.euclidchemical.com
 - c. Embeco 636 by BASF www.basfbuildingsystems.com
 3. Non-shrink Nonmetallic Grouts:
 - a. Bonsal Construction Grout by W. R. Bonsal Company www.bonsal.com
 - b. Hi-Flow Grout by Euclid Chemical Company www.euclidchemical.com
 - c. Kemset by ChemMasters Corporation www.chemmasters.net
 - d. Crystex by L & M Construction Chemicals, Inc www.lmcc.com
 - e. Masterflow 713 by Unicon of BASF www.unicon.ca
 - f. SonogROUT by BASF www.basfbuildingsystems.com
 5. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 FERROUS METALS

- A. Metal Fabrications Exposed to View:
 - 1. Provide materials selected for surface flatness, smoothness, and freedom from surface blemishes.
 - 2. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- B. Wide flange shapes and structural tees cut from: ASTM A992.
- C. Steel Shapes, Plates, and Bars: ASTM A36.
- D. Steel Tubing: Cold-formed, ASTM A500; or hot-rolled, ASTM A501. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A53.
- E. Structural Steel Sheet: Hot-rolled, ASTM E936; or cold-rolled ASTM 1008, Class 1; grade required for design loading.
- F. Steel Pipe:
 - 1. ASTM A53; Type, Grade B, as required for design loading.
 - 2. Black finish unless galvanizing is indicated.
 - 3. Galvanized finish for exterior installations and where indicated.
 - 4. Standard weight (Schedule 40) unless otherwise indicated.
- G. All other steel shapes, plates and bars: ASTM A36.
- H. Brackets, Flanges, and Anchors: Cast or formed metal of same type material, finish as supported rails, unless otherwise indicated.
- I. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM 153.
- J. Stainless Steel: ASTM A167 W/No. 2B Mill Finish.

2.03 FINISHES

- A. Steel and Iron Finishes:
 - 1. Galvanizing: Apply zinc-coating by the hot-dip process, complying with:
 - a. ASTM A153 for galvanizing iron and steel hardware.
 - b. ASTM A123 for galvanizing fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, forged shapes, plates, bars, and strips 0.0299 inch thick and heavier.
 - c. ASTM A386 for assembled steel products.

- B. Preparation for Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated.

2.04 FABRICATION, GENERAL

- A. Forming:
1. Form from materials of size, thickness, shapes indicated, complying with performance requirements indicated.
 2. Work to dimensions indicated or noted on Shop Drawings.
 3. Form exposed work true to line, level, with accurate angles and surfaces and straight sharp edges.
- B. Cutting and Shaping:
1. Shear, punch metals cleanly, accurately. Remove burrs.
 2. Ease exposed edges to radius of approximately 1/32 inch unless otherwise indicated.
 3. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 4. Remove sharp or rough areas on exposed traffic surfaces.
- C. Welding:
1. Comply with AWS recommendations.
 2. Use materials, methods to minimize distortion, develop strength and corrosion resistance of base metals.
 3. Fuse without undercut or overlap.
 4. Remove welding flux immediately.
 5. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Joints:
1. Form exposed connections with hairline joints flush, smooth, using concealed fasteners wherever possible.
 2. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.
 3. Locate joints where least conspicuous.
- E. Anchorage:
1. Provide for type indicated; coordinate with supporting structure.
 2. Fabricate, space anchoring devices to provide adequate support for intended use.
- F. Joints: Fabricate joints exposed to weather in manner to exclude water, or provide weep holes where water may accumulate.
- G. Shop Assembly:
1. Preassemble in shop to greatest extent possible.
 2. Disassemble only as necessary for shipping, handling limitations.

3. Use connections that maintain structural value of joined pieces.
4. Clearly mark for reassembly and coordinated installation.
5. Cut, reinforce, drill, tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

H. Finishes:

1. Comply with referenced NAAMM manual.
2. Finish metal fabrications after assembly.

2.05 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area.
- B. Drill plates to receive anchor bolts and for grouting as required.
- C. Galvanize after fabrication unless indicated otherwise.

2.06 LOOSE STEEL LINTELS

A. Fabrication:

1. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
2. Weld adjoining members together to form a single unit where indicated.

B. Sizing:

1. Size loose lintels for equal bearing of 1 inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated.
2. Galvanize loose steel lintels located in exterior walls unless indicated otherwise.

2.07 SHELF AND RELIEVING ANGLES

A. Fabrication:

1. Fabricate from steel angles of sizes indicated, for attachment to concrete framing.
2. Provide slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and not more than 24 inches on center, unless otherwise indicated.

B. Shelf Angles:

1. Galvanize shelf angles to be installed on exterior concrete framing.
2. Furnish wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

- C. Cavity Walls:
 - 1. Provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete.
 - 2. Align expansion joints in angles with indicated expansion joints in cavity wall exterior wythe.
- D. Furnish wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

2.09 PIPE BOLLARDS

- A. Fabricate pipe bollards from:
 - 1. Schedule 80 steel pipe.
 - 2. Cap bollards with ¼ inch minimum thickness steel base plate.
 - 3. Fabricate sleeves for bollard anchorage from steel pipe with ¼ inch thick steel plate welded to bottom of sleeve.

2.10 GABIONS

- A. Fabricate gabions from steel shapes as indicated on drawings.
 - 1. Wire: 6 gauge, 2-inch spacing.
 - 2. Wire and structural shapes shall be galvanized.

2.11 GROUT AND ANCHORING CEMENT

- A. Rough Hardware:
 - 1. Bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, other miscellaneous steel and iron shapes required for framing and supporting woodwork, anchoring or securing woodwork to concrete or other structures.
 - 2. Fabricate to sizes, shapes, dimensions required.
 - 3. Malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.
- B. Non-shrink Metallic Grout: Premixed, factory-packaged, (int. ferrous aggregate grout complying with CE CRD-C 621, only) specifically recommended by manufacturer for heavy duty loading applications of type specified in this section.
- C. Non-shrink Nonmetallic Grout: Premixed, factory-packaged, (non-staining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

2.12 FINISHES

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
 - 1. Refer to Section 09 91 50.

- B. Finish metal fabrications after assembly.
- C. Steel and Iron Finishes:
 - 1. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process in compliance with the following requirements:
 - a. ASTM A153 for galvanizing iron and steel hardware.
 - b. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
 - c. Use process for galvanizing that will prepare item for painting
 - 2. Primer Application:
 - a. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated.
 - b. Comply with requirements of SSPC PA1 "Paint Application Specification No. 1" for shop painting.
- D. Surfaces to Receive Fireproofing: In addition to above, shop paint only with materials that are approved by the fireproofing manufacturer in compliance with UL or FM assemblies.
- E. Galvanizing Repair Paint: High zinc dust content; dry film containing at least 94 percent zinc dust by weight; comply with DOD-P-21035 or SSPC-Paint-20.
- F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint-12 except containing no asbestos fibers.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that Metal Fabrications may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify Engineer. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Coordination:
 - 1. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction.
 - 2. Coordinate delivery of such items to Site.
- B. Utilize templates and other systems required to ensure accurate placement of items that will be embedded in concrete and masonry.

3.03 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Temporary Bracing: Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.04 SETTING LOOSE PLATES

- A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Setting: Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use metallic non-shrink grout in concealed locations where not exposed to moisture.
 - 2. Use nonmetallic non-shrink grout in exposed locations, unless otherwise indicated.
 - 3. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. Anchor supports securely to, and rigidly brace from, overhead building structure.

3.06 INSTALLATION OF BOLLARDS

- A. Anchor bollards in concrete by means of pipe sleeves preset and anchored into concrete.
 - 1. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with non-shrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
 - 2. Wrap bollard with bond breaker prior to installation of paving or slabs.

3.07 TOLERANCES

- A. Install in required position and within following tolerances:
 - 1. Maximum variation from plumb: 1/4 inch.
 - 2. Maximum offset from true alignment: 1/4 inch.

3.08 ADJUSTING AND CLEANING

- A. Galvanizing: For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- B. Collect offcuts and scrap and place in designated areas for recycling.

DIVISION 6 – WOOD, PLASTICS and composites

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

- A. Provide rough carpentry for building, storage garage and picnic shelters:
 - 1. Dimension lumber.
 - 2. Boards.
 - 3. Miscellaneous lumber.
 - 4. Plywood:
 - a. Plywood backing panels.
 - b. Roof sheathing.
 - c. Wall sheathing.
 - d. Underlayment.
 - 5. Oriented strand board:
 - a. Sheathing.
 - 6. Wood treatment:
 - a. Pressure preservative.
 - b. Fire-retardant.
 - 7. Rough carpentry accessories including, but not limited to:
 - a. Framing anchors and fasteners.
 - b. Sill sealer.
- B. Related Sections:
 - 1. Section 03 30 00 – Cast-in-Place Concrete
 - 2. Section 04 20 00 – Unit Masonry Assemblies
 - 3. Section 04 43 00 – Stone Masonry
 - 4. Section 05 12 00 – Structural Steel Framing
 - 5. Section 06 17 53 - Shop-Fabricated Wood Trusses
 - 6. Section 06 40 23 - Interior Architectural Woodwork
 - 7. Section 07 21 00 - Thermal Insulation
 - 8. Section 07 21 29 – Sprayed Insulation
 - 9. Section 07 27 00 – Air Barriers
 - 10. Section 07 46 33 – Plastic Siding
 - 11. Section 07 46 46 – Mineral-Fiber Cement Siding
 - 12. Section 09 29 00 - Gypsum Board

1.02 REFERENCES

- A. ANSI:
 - 1. A194 - Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature
 - 2. A208.1 - Mat-formed Wood Particle Board

- B. ASTM:
 - 1. A153 - Zinc Coating, Hot Dip, on Iron and Steel Hardware
 - 2. C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Pipe and Tubing
 - 3. E84 - Surface Burning Characteristics
 - 4. E96 - Test for Water Vapor Transmission
- C. AWPA U1 - Preservative Treatment by Pressure Process
- D. Engineered Wood Association (APA):
 - 1. E30 - Design/Construction Guide - Residential and Commercial
 - 2. E445 - Performance Standard and Policies for Structural-use Panels
- E. NFPA:
 - 1. Recommended Nailing Schedule
 - 2. Manual for Wood Frame Construction
 - 3. National Design Specifications for Wood Construction
 - 4. Surface Burning Characteristics of Building Materials
- F. UL 723 - Surface Burning Characteristics of Building Materials
- G. U.S. Department of Commerce (DOC) National Institute of Standards and Technology:
 - 1. PS 1 - U.S. Product Standard for Construction and Industrial Plywood
 - 2. PS 20 - American Softwood Lumber Standard

1.03 DEFINITIONS

- A. FRT: Fire-retardant treated wood
- B. NDS: National Design Specifications
- C. PT: Pressure treated

1.04 INSPECTION AGENCIES

- A. NLGA: National Lumber Grades Authority
- B. SPIB: Southern Pine Inspection Bureau
- C. WCLIB: West Coast Lumber Inspection Bureau
- D. WWPA: Western Wood Products Association

1.05 SUBMITTALS

A. Certificates:

1. Preservative Treatment: Treatment plant certification stating type of preservative solution and pressure process used, net amount of preservative retained, conformance with applicable standards.
2. Waterborne Treatment: Statement that moisture content was reduced to levels indicated prior to shipment to site.
3. Fire-Retardant Treatment: Treatment plant certification that treatment material complies with specified standards and other requirements.
4. For wood members treated with FRT chemicals, NDS for Wood Construction Section 2.3.4 requires submittal of design values, including connections, from the company providing the treatment and redrying service.
5. Submit organic chemical formulation, third party inspected, ICBO and NER report, EPA registered as a preservative, with a builder's warranty.

B. Wood Treatment Data: Chemical treatment manufacturer's instructions for handling, storing, installation, finishing.

1.06 QUALITY ASSURANCE

A. Corrosion of steel is an issue when in contact with preservative-treated wood at high moisture content levels. For FRT wood, the company providing the treatment should be contacted.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Storage:

1. Keep covered, dry.
2. Protect against exposure to weather, contact with damp or wet surfaces.
3. Stack lumber, plywood, and other panels; provide for air circulation within and around stacks, under temporary coverings including polyethylene and similar material.
4. For lumber and plywood pressure treated with waterborne chemicals, sticker between each course to provide air circulation.

1.08 PROJECT CONDITIONS

A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber, General:

1. Lumber Standards: Manufacture lumber to comply with DOC PS 20, applicable grading rules of referenced inspection agencies certified by ALSC Board of Review.
2. Grade Stamps: Factory-mark each piece with grade stamp of inspection agency evidencing compliance with grading rule requirements, grading agency, grade, species, moisture content at time of surfacing, and mill.
3. Nominal Sizes:
 - a. As indicated, except as shown by detail dimensions.
 - b. Actual sizes required by PS 20, moisture content specified for each use.
 - c. Dressed lumber, S4S, unless otherwise indicated.
 - d. Seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less nominal thickness, unless otherwise indicated.

B. Dimension Lumber:

1. Structural Framing: Hem Fir, No. 2 or as noted on Drawings; 2 inches to 4 inches thick, 2 inches or wider.
2. Stud Framing: "Stud" grade lumber, Hem-Fir, 2 inches to 4 inches thick, 2 inches to 6 inches wide, 10 feet and shorter.
3. Other Light Framing: "Construction" grade lumber, 2 inches to 4 inches thick, 2 inches or wider, Hem-Fir.

C. Boards:

1. Exposed:
 - a. Where exposed in finished work: Moisture content 19 percent maximum, "S-DRY."
 - b. Where painted finish indicated: Southern Pine, No. 2 boards per SPIB, or Douglas Fir Construction boards per WCLIB or WWPA.
2. Sizes: As indicated or, if not indicated, 1-inch by 8-inch boards.

D. Miscellaneous Lumber: Wood for support or attachment of other work, of sizes indicated, worked into shapes shown, and as follows:

1. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
2. Grade:
 - a. Standard grade light framing size lumber, any species or board size lumber as required.
 - b. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 boards per SPIB rules.

- E. Plywood Panels:
1. Comply with PS 1. For products not manufactured under PS 1 provisions, comply with APA E445.
 2. Trademark: Factory-mark each panel with APA trademark evidencing compliance with grade requirements.
 3. Provide exterior grade plywood at all locations unless specified otherwise.
 4. Concealed APA Performance-Rated Panels: Comply with requirements indicated for grade designation, span rating, exposure durability classification, edge detail where applicable, thickness.
 5. Type of Use:
 - a. Sheathing:
 - 1) Grade: APA C-D, exterior glue.
 - 2) Pressure preservative treated for roof parapet, curbs, etc.
 - 3) Thickness as indicated but at least 5/8 inch.
 - 4) Size: 4 feet by 8 feet.
 - b. Plywood backing panels:
 - 1) Mounting electrical or telephone equipment: Fire-retardant treated plywood panels with grade designation, APA C D PLUGGED INT with exterior glue, thickness indicated, or, if not otherwise indicated, not less than 1/2 inch nominal.
 - 2) Grab bar mounting:
 - a) APA C-D exterior glue.
 - b) Thickness as indicated, 5/8 inch minimum.
- F. Oriented Strand Board (OSB): 2-M-W (wafer board) in thickness, for application indicated; span rating required to suit spacing.
- G. Miscellaneous Materials:
1. Fasteners, Anchorages:
 - a. Size, type, material, finish indicated and recommended by applicable standards, Federal Specifications, and manufacturer for each use, including recommended nails.
 - b. Where rough carpentry work exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners, anchorages with hot-dip zinc coating (ASTM A153).
 2. Plywood Sheathing Clips: Simpson PSC, USP Structural Connectors, or approved equal.
 3. Adhesives for field gluing panels to framing: Formulation complying with APA AFG-01 or ASTM D3498 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers, with VOC content not more than 70 g/L.
- H. Wood Treatment by Pressure Process:
1. Preservative treatment for wood indicated as PT or specified to be treated:
 - a. Mark each treated item with AWWA Quality Mark requirements.
 - b. Complete fabrication of treated items prior to treatment whenever possible.

- c. It cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment.
 - d. Inspect each piece after drying, discard damaged or defective pieces.
 - e. For above ground items, kiln-dry to maximum moisture content of 19 percent or that allowed by National Grading Rules for the species and size specified to be dreid.
 - f. Comply with the following AWP A U1 standards:
 - 1) UC3A: Exterior, above ground, coated and rapid water runoff, such as coated millwork, siding, and trim.
 - 2) UC3B: Exterior, above ground, uncoated or poor water runoff such as decking, railings, fence posts, uncoated millwork.
 - 3) UC4A: Ground contact or fresh water such as fence, deck, guardrail and utility posts (low decay areas).
 - 4) UC4B: Ground contact or fresh water, difficult replacement (high decay areas).
 - 5) UC4C: Ground contact or fresh water, critical structural components such as foundation piling (severe decay areas).
2. Fire-Retardant Treatment:
- a. Where FRT (FRTW) is indicated, pressure impregnate with fire-retardant chemicals to comply with AWP A Replace with UCFA (interior, not in contact with ground) and UCFB (exterior, not in contact with ground or foundations).
 - 1) Chemical shall provide protection against termites and fungal decay.
 - 2) Chemical shall be free of halogens, sulfates, and ammonium phosphate.
 - b. Identify with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection or other testing and inspecting agency acceptable to authorities having jurisdiction.
 - c. Interior Type B: Use wherever wood is indicated for interior applications.
 - d. Inspect each piece of plywood after drying; discard damaged or defective pieces.
 - e. All FRT wood to be in contact with steel shall be non-corrosive.
 - 1) Contact company providing FRT treatment.
 - 2) FRT in contact with carbon steel, galvanized steel, aluminum, copper and red brass shall exhibit corrosion rates less than 1 mil per year when tested according to Fed. Spec. MIL-L-19140.
 - f. Product: Dricon Fire Retardant Treated Wood, Smyrna, GA, Hoover Treated Wood Products, or approved equal.
3. Use chemicals acceptable to authorities having jurisdiction and containing no chromium or arsenic.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that rough carpentry may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies:
 - 1. Immediately notify architect.
 - 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 3. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION, GENERAL

- A. Coordinate and fit carpentry work to other Work.
 - 1. Scribe, cope as required for accurate fit.
 - 2. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other Work.
- B. Set carpentry work to required levels and lines, with members plumb and true to line, cut, and fitted.
- C. Defective Units: Discard if defects might impair quality of work, or if units are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- D. Fastening:
 - 1. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.
 - 2. Countersink nail heads on exposed carpentry work, fill holes.
 - 3. Make tight connections between members.
 - 4. Install fasteners without splitting of wood, pre-drill as required.

3.03 WOOD GROUNDS, NAILERS, BLOCKING, SLEEPERS

- A. Provide where shown and where required for screeding or attachment of other work.
- B. Form to shapes shown and cut as required for true line and level of work to be attached.
- C. Coordinate location with other work involved.
- D. Attach to Substrates:
 - 1. As required to support applied loading.
 - 2. Countersink bolts, nuts flush with surfaces, unless otherwise indicated.

3. Build into masonry during installation of masonry work.
 4. Where possible, anchor to formwork before concrete placement.
- E. Grounds:
1. Permanent, of dressed, preservative treated, key-beveled lumber.
 2. Not less than 1-1/2 inches wide.
 3. Thickness required to bring face of ground to exact thickness of finish material involved.
 4. Remove temporary grounds when no longer required.
- F. Blocking:
1. Provide 2 by 8 wood blocking behind wall-mounted fixtures.
 2. Window treatment blocking shall extend 8 inches minimum beyond window opening.
 3. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.04 WOOD FURRING

- A. Installation:
1. Plumb, level with closure strips at edges and openings.
 2. Shim with wood as required for tolerance of finished work.
 3. Provide fire treated wood for all furring.
 4. Firestop furred spaces on walls at each floor level and at ceiling line of top story, with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

3.05 WOOD FRAMING, GENERAL

- A. Framing Members:
1. Sizes, on spacings shown, frame openings as shown, or if not shown, comply with recommendations of NFPA "Manual for Wood Frame Construction."
 2. Do not splice structural members between supports.
- B. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for Wood Frame Construction" and "National Design Specifications for Wood Construction" published by NFPA.
- C. Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely fitted wood blocks of nominal 2-inch-thick lumber of the same width as framing members.
- D. Install sill sealer under sills and where exterior wood framing abuts masonry or concrete.

3.06 STUD FRAMING

- A. Unless otherwise shown, use 2 by 4 or 2 by 6 wood studs spaced 16 inches on center with wide face perpendicular to direction of wall or partition.
- B. Provide single bottom plate and double-top plates 2 inches thick by width of studs. Nail or anchor plates to supporting construction.
- C. Studs shall be doubled (1 stud and 1 trimmer at all door and window openings) to provide 1-1/2 inch lintel bearing at each end for full width of lintel, unless noted otherwise.
- D. Construct corners and intersections with not less than 3 studs.
 - 1. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.
 - 2. Brace all corners with 20-gage metal strap bracing.

3.07 INSTALLATION OF CONSTRUCTION PANELS

- A. Plywood Installation:
 - 1. Comply with applicable recommendations contained in Form No. E30, "APA Plywood Design/ Construction Guide," Residential and Commercial," for types of plywood products and applications indicated. Comply with "CodePlus" provisions of above referenced guide.
 - 2. Fastening Methods:
 - a. Sheathing: Nail to framing.
 - b. Plywood backing panels: Nail or screw to supports.
- B. Oriented Strand Board (OSB) Installation:
 - 1. Allow 1/16 inch spacing at panel ends and 1/8 inch at panel edges, unless noted otherwise by manufacturer.
 - 2. Nails: Cement coated box nails, unless otherwise noted.
 - 3. Stapling of oriented Strand board not permitted.
 - 4. Wall Sheathing:
 - a. Place vertically with joints over studs, plates or 2-inch blocking.
 - b. Protect panels against damage until roofing is installed.
 - c. Attach to CMU with Tap Con screws, ITW Redhead, or equal.
 - d. Stagger end joints and allow 1/8 inch space. End joints shall occur on supports. Space panel edges 1/8 inch.
 - e. Nail 6 inches on center along panel edges and 12 inches on center at intermediate supports.
 - f. Use 8d coated box nails.
 - 5. Roof Sheathing:
 - a. Install with face grain perpendicular to the direction of the framing members and with cross joints staggered. Panel and joints shall occur over framing.
 - b. Allow 1/8 inch spacing at panel ends and edges.

- c. Nail 6 inches on center along panel edges and 12 inches at intermediate supports.
- d. Use 10d coated nails.
- e. Maximum edge distance for all nailings in plywood shall be 3/8 inch.

3.08 SCHEDULES

- A. Nailing Schedule: Comply with "Nailing Schedule" in International Building Code 2304.9, unless more stringent requirements are specified.
- B. Pressure Treated Wood Preservative: Where indicated on Drawings or if not indicated, including but not limited to:
 - 1. Sill plates in contact with concrete or masonry.
 - 2. Roof blocking and framing used for built-up roofing and single membrane roofing.

3.09 CLEANING

- A. Do not allow accumulation of scraps and debris. Maintain premises in neat, orderly condition at all times.

SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide wood trusses:
 - 1. Common.
 - 2. Hipset.
 - 3. Monopitch.
 - 4. Girder.
 - 5. Parallel chord trusses.
 - 6. Accessories including, but not limited to:
 - a. Lateral bracing.
 - b. Fasteners, connectors, anchorage devices, bolts, clips, etc.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry
- C. Alternates: Refer to Section 01 23 00.
- D. Unit Prices: Refer to Section 01 27 00.

1.02 REFERENCES

- A. American Institute of Timber Construction - Timber Construction Standards
- B. ASTM:
 - 1. A653 - Steel Sheet, Galvanized or Galvannealed by Hot Dip Process
 - 2. A666 - Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate
 - 3. A780 - Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
- C. Truss Plate Institute (TPI):
 - 1. TPI 1 - National Design Standard for Metal Plate Connected Wood Truss Construction
 - 2. TPI DSB - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses
 - 3. TPI HIB - Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses
- D. International Building Code

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and erect wood trusses to withstand specified design loads within limits and under conditions required.
 - 1. Design Loads: As specified.
 - 2. Deflections: Live load deflection meeting the following (unless otherwise specified):
 - a. Roof trusses: Vertical deflection less than or equal to $1/360$ of the span.
 - 3. Design framing systems to provide for movement of framing members without damage or over-stressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 degrees F.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Product Data:
 - 1. Complete materials list of items to be provided including manufacturer specifications and other data to prove compliance with specified requirements.
 - 2. Wood Treatment Data: Chemical treatment manufacturer's instructions for handling, storing, installation, finishing.

3. Treatment Certificates:
 - a. Preservative treatment: Treatment plant certification stating type of preservative solution and pressure process used, net amount of preservative retained, conformance with applicable standards.
 - b. Waterborne treatment: Statement that moisture content was reduced to levels indicated prior to shipment to Site.
 - c. Fire-retardant treatment: Treatment plant certification that treatment material complies with specified standards and other requirements.
 - d. For wood members treated with FRT chemicals, NDS for Wood Construction Section 2.3.4 requires submittal of design values, including connections, from the company providing the treatment and redrying service.
 - e. Submit organic chemical formulation, third party inspected, ICBO and NER report, EPA registered as a preservative, with a builder's warranty.
 4. Submit product data for each composite wood product used indicating that products contain no urea formaldehyde.
- C. Shop Drawings: Show species, sizes, stress grades of lumber proposed to be used, pitch, span, camber, configuration, spacing of truss, connector type thickness, size, location, design value, splice and bearing details of trusses.
- D. Installation Procedure: Manufacturer's complete recommended installation procedures that will become basis for accepting or rejecting actual installation.
- E. Design Calculations: Submit, if required, complete design calculations for trusses as necessary to obtain building permits, other acceptance.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain metal connector plates from a single manufacturer.
- B. Qualifications:
1. Structural Engineer: Provided by manufacturer, registered to practice in Wisconsin to design wood trusses to sustain indicated loads, specified or required by local codes, with spans, profiles, and arrangements shown on Drawings.
 2. Fabricator: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Engineer and authorities having jurisdiction.
 3. Installers: Only skilled workers completely familiar with requirements and methods needed for proper performance of work of this section.
- C. Referenced Standards:
1. Comply with pertinent provisions of TPI 1, TPI DSB, and TIP HIB.
 2. Comply with applicable requirements in AF&PA's National Design Specifications for Wood Construction and its Supplement.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work follows.
- B. Storage and Protection:
 - 1. Protect materials before, during, after installation.
 - 2. Protect installed work, materials of other trades.
 - 3. Prevent contact with ground or other horizontal surface.
 - 4. Provide for air circulation around stacks and under coverings.

1.07 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Wood Trusses:
 - 1. Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. Fargo Truss Systems, Fargo, ND
 - b. Littfin Truss, Winsted, MN
 - c. Lloyd Trusses, Mankato, MN
 - d. Mathew Hall Lumber Company, St. Cloud, MN
 - e. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
- B. Fire Treated Wood Trusses:
 - 1. Standard of Quality: Design is based on products of Dricon Fire Retardant Treated Wood, Smyrna, GA www.dricon.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. FirePro by Osmose www.osmose.com
 - b. Hoover Treated Wood Products, Thomson, GA www.frtw.com
 - c. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 PRODUCTS

- A. Lumber: DOC PS 20 and applicable rules of grading agencies certified by ALSC Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.

3. Provide dressed lumber, S4S.
 4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, capable of supporting required loads without exceeding allowable design values, according to AF&PA.
- C. Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00.
- D. Metal Connector Plates: Comply with TPI 1.
1. Interior Locations:
 - a. Hot-dip galvanized steel sheet meeting ASTM A653.
 - 1) Structural steel, high strength, low alloy Type A.
 - 2) High strength low alloy steel Type B.
 - 3) Not less than 0.036 inch thick.
 - b. Stainless steel:
 - 1) ASTM A666, Type 304.
 - 2) Minimum 0.035 inch thick.

2.03 FIRE-RETARDANT TREATED LUMBER

- A. Where FRT is indicated, pressure impregnate with fire-retardant chemicals to comply with AWPA C20.
1. Use Exterior type for exterior locations and where indicated.
 2. Use Interior Type A, High Temperature (HT) for enclosed roof trusses and where indicated.
 3. Use Interior Type A, unless otherwise indicated.
- B. Identify wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction:
- C. For exposed trusses and bracing indicated to receive a stained or natural finish, mark end or back of each piece.
- D. All FRT wood to be in contact with steel shall be non-corrosive. Contact company providing FRT treatment.
- E. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.04 ACCESSORIES

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

2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153.
- B. Anchor Clips: Teco, “Trip-L-Grip” galvanized framing anchor at each truss end.
- C. Tie-Downs:
1. Bent strap tie for fastening roof trusses to wall studs below.
 2. 2-1/4 inches wide by 0.062 inch thick.
- D. Roof Truss Clips:
1. Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls.
 2. 1-1/4 inches wide by 0.05 inch thick.
 3. Fasten clip to truss through slotted holes to allow for truss deflection.
- E. Other Materials: Other materials not specifically described, but required for complete and proper installation as selected by contractor subject to acceptance of Engineer.

2.05 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which work will be performed.
- B. Discrepancies: Correct conditions detrimental to timely, proper completion of work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

- A. Coordinate with other trades performing Work that interfaces this section.

- B. Install trusses only after supporting construction is in place and is braced and secured.

3.03 INSTALLATION

- A. Install work in strict accordance with original design, accepted Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, TPI recommendations, and manufacturer's recommended installation procedures.
- B. Hoist into position with proper bracing secured at designated lifting points.
- C. Do not bend trusses. Install temporary, horizontal, cross bracing to hold trusses plumb and in safe condition until permanent bracing is installed.
- D. Install permanent bracing, related components prior to application of loads to trusses.
- E. Tighten loose connectors. Restrict construction loads to prevent over-stressing of truss members. Install within installation tolerances in TPI 1.
- F. Do not cut or remove truss members.
- G. Replace wood trusses that are damaged or do not meet requirements.
- H. Do not alter trusses in field.

3.04 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- B. Protective Coating:
 - 1. Clean and prepare exposed surfaces of metal connector plates.
 - 2. Brush apply primer, when part of coating system, and 1 coat of protective coating to dry film thickness recommended by coating system manufacturer.

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Cabinets:
 - a. Hardwood veneer.
 - b. High pressure decorative plastic laminate.
 - 2. Countertops:
 - a. High pressure decorative plastic laminate.
 - b. Solid surfacing.

- 3. Architectural woodwork accessories including, but not limited to:
 - a. Hardware.
 - b. Filler strips.
 - c. Fasteners and anchors.
 - d. Joint sealant.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry

1.02 REFERENCES

- A. ANSI:
 - 1. A208 - Particleboard
- B. ASTM:
 - 1. D1037 - Evaluating Properties of Wood-Based Fiber and Particle Panel Materials
 - 2. D3201 - Hydroscopic Properties of Fire Retardant Wood and Wood Based Products
- C. AWI - Quality Standards of the Architectural Woodwork Industry
- D. NEMA LD3

1.03 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
- B. HCS: Horizontal, Through-Color Standard
- C. HGF: Horizontal Fire Rated
- D. HGP: Horizontal, General Purpose, Postforming
- E. HGS: Horizontal, General Purpose, Standard
- F. VGP: Vertical, General Purpose, Postforming
- G. VGS: Vertical, General Purpose, Standard
- H. VOC: Volatile Organic Compound

1.04 SUBMITTALS

- A. Provide submittals according to Division 01.

- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations for each product, process specified.
- C. Provide product data indicating percentages by value of rapidly renewable interior architectural woodwork products and total cost of all interior architectural woodwork materials.
- D. Samples:
 - 1. Color Samples: Submit manufacturer's standard color samples with Product Data and Shop Drawings for each product specified.
- E. Environmental Submittals:
 - 1. Comply with VOC regulations for adhesives and finishes.
 - a. Wood glues: 30 g/L.
 - b. Contact adhesive: 250 g/L.
- F. Shop Drawings:
 - 1. Show system fabrication, installation drawings.
 - 2. Show location of each item, dimensioned plans and elevations, large-scale (full size) details, attachment devices, and other components.
 - 3. Locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other sections.
 - 4. Locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide architectural woodwork units made of components of standard construction furnished by 1 manufacturer as coordinated and sequence-matched assemblies.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of architectural woodwork.
 - 2. Contractor: 3 years experience in the installation of architectural woodwork.
 - 3. Personnel: For actual installation of architectural woodwork, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of Work.
- C. Regulatory Requirements:
 - 1. Fire-Test-Response Characteristics: Comply with UL, ITS, or other testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

- E. Field Samples: If requested, furnish sample of each type of architectural woodwork to architect for review prior to manufacture/ installation. Architect will forward approved sample to the Site for installation.
- F. Preinstallation Meetings: Installer and manufacturer's technical representative shall meet with architect prior to the start of casework fabrication and installation if requested.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Do not delivery woodwork until painting and similar operations that could damage woodwork have been completed in installation area.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Woodwork Manufacturer:
 - a. Establish optimum moisture content, required temperature, and humidity condition.
 - b. Advise installer regarding temperature, humidity requirements for woodwork installation and storage areas.
 - 2. Installer:
 - a. Do not install until required temperature, relative humidity have been stabilized and will be maintained in installation areas.
 - b. Maintain temperature, humidity in installation area as required to maintain moisture content of installed woodwork within 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period.
 - c. Machining plastic products produces hazardous dust. Protect surrounding areas from dust.
- B. Existing Conditions:
 - 1. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work.
 - 2. Field-verify dimensions and assume full responsibility for their accuracy.
 - 3. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.08 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other sections to ensure that interior architectural woodwork can be supported and installed as indicated.

- B. Hardware Coordination: Distribute copies of approved hardware schedule to fabricator of architectural woodwork. Coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cabinets

1. High pressure decorative plastic laminate (PL-1):
 - a. Meet applicable requirements of AWWA UCFA.
 - b. Standard of Quality: Design is based on products of Formica Corporation (The Diller Corporation), unless noted otherwise. www.formica.com
 - c. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Wilsonart LLC www.wilsonart.com
 - b. Pionite (Panolam Industries International, Inc.) www.pionite.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

B. Countertops:

1. High pressure decorative plastic laminate (PL-2):
 - a. Meet applicable requirements of AWWA UCFA.
 - b. Standard of Quality: Design is based on products of Formica Corporation (The Diller Corporation), unless noted otherwise. www.formica.com
 - c. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Wilsonart LLC www.wilsonart.com
 - b. Pionite (Panolam Industries International, Inc.) www.pionite.com
 - c. Manufacturer of comparable products meeting requirements of specifications.
2. Solid surfacing:
 - a. Standard of Quality: Design is based on Corian (DuPont), unless noted otherwise. www.corian.com
 - b. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Wilsonart LLC www.wilsonart.com
 - b. Pionite (Panolam Industries International, Inc.) www.pionite.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

- C. Woodwork Accessories:
1. Cabinet Hardware and Accessory Materials:
 - a. Standard of Quality: Design is based on Knap & Vogt (K&V) www.knapandvogt.com
 - b. Other acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. National
 - b. Stanley Manufacturing Co. www.stanleyhardware.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood:
1. Pressure impregnated with fire-retardant chemicals. Comply with following requirements:
 - a. Use chemicals of type, for applications indicated which do not bleed-through or otherwise adversely affect finishes.
 - b. Do not use colorant in solution to distinguish treated lumber from untreated lumber.
 - c. Use low hygroscopic type halogen, sulfate-free solution intended for interior applications not exposed to relative humidities in excess of 95 percent; with treated material having equilibrium moisture content of not over 28 percent per ASTM D3201 at 92 plus 2 percent relative humidity.
 2. Marking: Identify treated lumber with separable paper classification marking of inspecting, testing agency acceptable to authorities having jurisdiction.
 3. Milling: Mill lumber after treatment, within limits set for wood removal which does not affect listed fire performance characteristics, using woodworking plant certified by testing, inspecting agency.
 4. Kiln-dry after treatment to levels required for non-fire-retardant treated woodwork materials. Maintain moisture content required by kiln drying, before and after treatment.
- B. Woodwork Substrates:
1. Fire-Rated: Particleboard meeting Underwriter's Laboratories, Inc., Standard Tests for surface burning characteristics of burning materials (UL 723) and ASTM E119.
 2. Cabinet Substrate: Industrial grade medium density fiberboard with formaldehyde free binder meeting the following requirements:
 - a. Density: 48 pounds per cubic foot.
 - b. Internal bond: 115 pounds per square inch.
 - c. Screw holding (face): 325 pounds required to pull a 1 inch, No. 10 metal screw.
 - d. Screw holding (edge): 275 pounds required to pull a 1 inch, No. 10 metal screw.
 - e. Water absorption: 16 to 8 percent - 24-hour soak test (average).
 - f. Thickness swell: 8 to 6 percent - 24 hour soak test (average).

3. Countertop Substrate:
 - a. Exterior grade, medium density fiberboard with formaldehyde free binder, meeting the following requirements:
 - a. Density: 48 pounds per cubic foot.
 - b. Internal bond: 130 pound per square inch.
 - c. Screw holding (face): 325 pounds required to pull a 1-inch, No. 10 metal screw.
 - d. Screw holding (edge): 275 pounds required to pull a 1-inch, No. 10 metal screw.
 - e. Water absorption: 12 percent - 24-hour soak test (average).
 - f. Thickness swell: 8 percent - 24-hour soak test (average).
 - g. ASTM D1037: 50 percent (minimum) MOR retained.

C. Cabinets

1. Hardwood veneer:
 - a. Custom fabricated.
 - b. Comply with AWI Section 400 requirements for wood cabinets.
 - c. Finish: Transparent.
 - d. Grade: Premium.
 - e. Species: Red oak, plain sawn.
 - f. Materials for Semiexposed Surfaces:
 - a. Surfaces other than drawer bodies: Thermoset decorative overlay.
2. High pressure decorative plastic laminate (PL-1):
 - a. Comply with NEMA LD 3.
 - b. General Purpose:
 - a. Grade: 10/HGS.
 - b. NEMA Type GP-50.
 - c. Nominal thickness: 0.045 inch.
 - d. Intended use: Interior horizontal or vertical surfaces where design, appearance, quality, durability, and resistance to stain and heat from ordinary sources are required.
 - c. Vertical Non-forming Surfaces:
 - a. Grade: General Purpose -55/VGS.
 - b. NEMA Type GP-28.
 - c. Nominal thickness: 0.028 inch.
 - d. Intended use: Interior vertical surfaces where design, appearance, quality, durability, and resistance to stain and heat from ordinary sources are required.
 - d. Post-forming Surfaces:
 - a. Grade: 12/HGP.
 - b. NEMA Type PF-42.
 - c. Nominal thickness: 0.042 inch.
 - d. Intended use: Interior horizontal or vertical surfaces requiring 1/2 inch or greater radiused edges and where design, appearance, quality, durability, and resistance to stain and heat from ordinary sources are required.

- e. Vertical Post-forming Surfaces:
 - a. Grade: 20/VGP.
 - b. NEMA Type PF-30.
 - c. Nominal thickness: 0.030 inch.
 - d. Intended use: Interior vertical surfaces requiring 3/8 inch or greater radiused edges and where design, appearance, quality, durability, and resistance to stain and heat from ordinary sources are required.
 - f. Materials for Semiexposed Surfaces:
 - a. Surfaces other than drawer bodies: High-pressure decorative laminate, Grade GP-28
- D. Countertops:
 - 1. High pressure decorative plastic laminate (PL-2):
 - a. Comply with NEMA LD 3.
 - b. General Purpose:
 - a. Grade: 10/HGS.
 - b. NEMA Type GP-50.
 - c. Nominal thickness: 0.045 inch.
 - d. Intended use: Interior horizontal or vertical surfaces where design, appearance, quality, durability, and resistance to stain and heat from ordinary sources are required.
 - c. Post-forming Surfaces:
 - a. Grade: 12/HGP.
 - b. NEMA Type PF-42.
 - c. Nominal thickness: 0.042 inch.
 - d. Intended use: Interior horizontal or vertical surfaces requiring 1/2 inch or greater radiused edges and where design, appearance, quality, durability, and resistance to stain and heat from ordinary sources are required.
 - d. Materials for Semiexposed Surfaces:
 - a. Surfaces other than drawer bodies: High-pressure decorative laminate, Grade GP-28
 - 2. Solid surfacing:
 - a. Type: Homogeneous solid sheets of filled plastic resin complying with ANSI Z124.3 for Type 5 or Type 6 material and performance requirements, without a precoated finish; ASTM A276 Type 316L.
- E. Architectural woodwork accessories:
 - 1. Provide cabinet hardware and accessory materials associated with architectural cabinets.
 - a. Cylinder locks: National Lock Camlock Disc Tumbler 8050 series, US 26D, 1 per drawer or door leaf where indicated.
 - b. Cabinet hinges:
 - a. Heavy duty, 5-knuckle, 2-3/4-inch institutional type hinge.
 - b. Meet BHMA 156.9 Grade 1.
 - c. Mill ground, hospital tip, Teflon coated tight pin feature with all edges eased.

- d. Full wrap-around type, 0.095-inch-thick.
- e. Full 270 degree door swing.
- f. Finish: Powder finish
- g. Color: As selected by Architect from manufacturer's full range.
- h. Option: Concealed European-style concealed hinges with lifetime material replacement guarantee and 170 degree swing. Fully adjustable, self-closing.
- i. Number per door: 2 per leaf up to 3 foot high; 3 per leaf 3 foot to 5 foot high, 4 per leaf 5 foot to 7 foot high, 5 per leaf 7 foot to 8 foot high.
- c. Cabinet door and drawer pulls: Stanley No. 4484.
- d. Magnetic catches: Stanley No. 41.
- e. Drawer slides: KV 1429-100# full extension drawer slides.
- f. Adjustable shelf standards: KV No. 255 with 256 support clip, unless indicated otherwise on Drawings.
- g. Shelf support pins: KV 333ZC.
- h. Counter support brackets: ASTM A167 304 painted steel.
- 2. Fasteners and Anchors:
 - a. Nails and screws:
 - a. Countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails or finishing screws.
 - b. Anchors:
 - a. Material, type, size, finish required by each substrate for secure anchorage.
 - b. Non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations, elsewhere as required for corrosion-resistance.
 - c. Toothed steel or lead expansion bolt devices for drilled-in-place anchors.
 - d. Furnish inserts, anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.
- 3. Grommets for cable passage through countertops:
 - a. 2 inch.
 - b. Black.
 - c. Molded-plastic and matching plastic caps with slot for wire passage.
- 4. Joint Sealant: 1-part polyurethane.

2.03 FABRICATION

A. General:

- 1. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in installation areas.

2. Fabrication:
 - a. Fabricate to dimensions, profiles, details indicated with openings, mortises precut, where possible, to receive hardware, other items and work.
 - b. Ease edges to 1/16 inch radius for corners of cabinets, edges of solid wood members less than 1 inch nominal thickness, 1/8 inch radius for edges of rails, similar members over 1 inch nominal thickness.
 3. Assembly:
 - a. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Site to maximum extent possible.
 - b. Disassemble components only as necessary for shipment and installation.
 - c. Where necessary for fitting at site, provide ample allowance for scribing, trimming, fitting.
 4. Pre-cut Openings:
 - a. Fabricate, where possible, to receive hardware, appliances, plumbing fixtures, electrical work, similar items.
 - b. Locate openings accurately, use templates or roughing-in diagrams for proper size, shape.
 - c. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with water-resistant coating.
 5. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements, verify dimensions, Shop Drawing details as required for accurate fit.
- B. Cabinets and Countertops:
1. Finish:
 - a. Wood finish:
 - a. Grain matching: Run and match grain vertically for drawer fronts, doors and fixed panels.
 - b. High pressure decorative plastic laminate:
 - a. General purpose.
 - b. Chemical/stain resistant.
 - c. Solid surfacing:
 - a. Fabricate in 1 piece, unless otherwise indicated.
 - b. Wrap down to cover all tops and vertical edges of the countertops and splash.
- C. Grommets: Install in countertops at locations as directed by architect.

2.04 SOURCE QUALITY CONTROL

- A. Standing and Running Trim, Shelving and Rails: Comply with AWI Section 300.
- B. Surfacing and Countertops: Comply with AWI Section 400 and its Division 400C.

2.05 FINISH

A. Cabinets:

1. Hardwood veneer:
 1. Grade: Provide finishes of same grades as items to be finished.
 2. Transparent finish:
 - a. Stain coat:
 - a) Finish: Alkyd-based, VOC compliant wiping stain
 - b) Color: To be chosen from manufacturer's standard range of colors by architect.
 - b. Finish coats:
 - a) Finish: Minimum of two (2) coats of Alkyd-based or polyurethane satin varnish as recommended by manufacturer.
 - c. Finish architectural woodwork, stain and finish coats at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
 3. Plastic Laminate (PL-1):
 - a. Color: Earth Wash 7213-58 as manufactured by Formica Corporation (The Diller Corporation)

B. Countertops:

1. Plastic Laminate (PL-2):
 - a. Color: Mineral Spa 6920-58 as manufactured by Formica Corporation (The Diller Corporation)
2. Solid Surfacing
 - a. Color: Hazelnut as manufactured by Corian (DuPont)

C. Preparation for Finishing:

1. Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
2. Whenever plastic laminate or finished surface is discontinued due to cutting, routing, or other means, seal edges of coreboard materials and wood surfaces to prevent off-gassing during use.

D. Backpriming:

1. Apply 1 coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork.
2. Apply 2 coats to back of paneling and to end-grain surfaces.
3. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

- E. Standing and Running Trim, Shelving and Rails:
 - 1. Standards and Brackets: Anachrome.
- F. Woodwork Accessories:
 - 1. Hardware.
 - 2. Joint Sealant: Color to be selected by architect from standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that architectural woodwork may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies:
 - 1. Immediately notify architect.
 - 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 3. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Environmental Conditions:
 - 1. Verify that prevailing temperature, humidity conditions are within acceptable range prior to beginning installation.
 - 2. Proceed only when work which may be detrimental to woodwork is complete and all involved parties agree that acceptable environmental conditions can be maintained for duration of Project.

3.03 INSTALLATION

- A. General Requirements:
 - 1. Install plumb, level, true, straight, with no distortions.
 - 2. Shim as required using concealed shims. Install to tolerance of 1/8 inch in 8 feet for plumb and level (including tops); with no variations in flushness of adjoining surfaces.
 - 3. Scribe, cut to fit adjoining work.
 - 4. Refinish cut surfaces or repair damaged finish at cuts.
- B. Pressure Treated Wood: Handle, store, install in compliance with recommendations of chemical treatment manufacturer, including those for adhesives, where required for installation.

- C. Anchoring:
 - 1. Anchor woodwork to anchors or blocking built-in or directly attached to substrates.
 - 2. Secure to grounds, stripping, blocking with countersunk, concealed fasteners, blind nailing as required for complete installation.
 - 3. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.
 - 4. Match final finish where transparent finish is indicated.
- D. Cabinets:
 - 1. Install without distortion so that doors and drawers fit openings properly and are accurately aligned.
 - 2. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
 - 3. Complete installation of hardware, accessory items as indicated.
 - 4. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
- E. Countertops:
 - 1. Anchor securely to base units and other support systems as indicated.
 - 2. Match adhesive to countertop.
- F. Joint Sealant: Seal all cabinet or countertop wall joints.

3.04 ADJUSTMENT

- A. Damaged and Defective Woodwork:
 - 1. Repair where possible to eliminate defects functionally and visually.
 - 2. Where not possible to repair, replace woodwork.
 - 3. Adjust joinery for uniform appearance.

3.05 CLEANING

- A. Woodwork:
 - 1. Clean exposed and semi-exposed surfaces.
 - 2. Touch-up shop-applied finishes to restore damaged or soiled areas.
- B. Hardware: Clean, lubricate and adjust.

3.06 PROTECTION

Provide final protection, maintain conditions, in manner acceptable to fabricator and installer, to ensure architectural woodwork is without damage or deterioration at time of substantial completion.

SECTION 06 82 00 - GLASS-FIBER-REINFORCED PLASTIC PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Plastic coated panel.
 - 2. Panel trim.
 - 3. Glass fiber reinforced plastic panel accessories including, but not limited to:
 - a. Fasteners and adhesives.
- B. Related Sections:
 - 1. Section 04 20 00 – Unit Masonry Assemblies
 - 2. Section 09 29 00 - Gypsum Board

1.02 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Meet Class C flamespread of 200 or less, smoke developed of 450 or less per ASTM E84.
 - 2. Barcol Hardness (scratch resistance) minimum of 55 per ASTM D2583.
 - 3. Gardner Impact Strength of 40 in-lb showing no visible damage on front side per ASTM D5420.

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings:
 - 1. Submit Shop Drawings showing system fabrication, installation drawings, including plans, elevations, sections, details of components, joint locations, and configurations within system and between system and adjoining system.
- D. Samples:
 - 1. Initial Selection: Submit manufacturer's standard color samples for each type of finish with Product Data and Shop Drawings.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide glass fiber reinforced plastic panels units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.

- B. Qualifications:
1. Manufacturer: 5 years' experience in the manufacture of glass fiber reinforced plastic panels.
 2. Contractor: 3 years' experience in the installation of glass fiber reinforced plastic panels.
 3. Personnel: For actual installation of glass fiber reinforced plastic panels, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

1.05 PROJECT CONDITIONS

- A. Drawings do not purport to show actual dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.
- B. Do not begin installation until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete, other work has dissipated.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Glass Fiber Reinforced Plastic Panels and Trim:
1. Standard of Quality: Unless indicated otherwise, design is based on products of Crane Composites (Kemlite) www.glasbord.com
 2. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. Conwed Designscape, Ladysmith, WI
www.conweddesignscape.com
 - b. Glasteel, Collierville, TN
 - c. Marlite Company, Dover, OH
 - d. Vista Panels, Ontario, Canada www.vistapanel.com
 - e. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Glass Fiber Reinforced Plastic Panel:
1. Embossed.
 2. 0.10 inch thick minimum.
 3. Product: Glasbord.
 4. Color: White.

- B. Panel Trim:
 - 1. Trim: Standard trim pieces by panel manufacturer.
 - 2. Color: To match panel.
 - 3. Battens: 8 foot lengths, flat batten.
 - 4. Ceiling Trim: 8 foot lengths, inside corner.
 - 5. Edge Trim: 8 foot lengths, edge trim.
 - 6. Outside Corners: 8 foot lengths of outside angle.
 - 7. Outside Corners Guard: 8 foot lengths of outside corner guard.
- C. Glass Fiber Reinforced Plastic Panel Accessories:
 - 1. Fasteners and Adhesives:
 - a. Mechanical fasteners: Countersunk screws.
 - b. Adhesive: Construction adhesive recommended by panel manufacturer.
 - 2. Sealant: Silicone construction sealant.
 - 3. Other Materials: Other materials not specifically described but required for complete, proper installation of glass fiber reinforced plastic panels, subject to acceptance of architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that glass fiber reinforced plastic panels may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. Install panel vertically over substrate.
 - 1. Apply adhesive beads to face of wall and back of panels.
 - 2. Use minimum number of trim pieces.
 - 3. Minimum length of trim is 4 foot.
 - 4. Adhesive-apply flat batten strips and inside and outside corners.
 - 5. Use bead of silicone sealant at all corners, tops, bottoms of panels.

3.03 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.

- B. System:
 - 1. Clean exposed surfaces of glass fiber reinforced plastic panels using materials and methods recommended by manufacturer.
 - 2. In event of spilling or splashing compound of finish material onto other surfaces, immediately remove spilled or splashed material and all trace of residue to acceptance of architect.

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide cold-applied, emulsified asphalt dampproofing and accessories including, but not limited to:
 - 1. Asphalt emulsion primer.
- B. Related Sections:
 - 1. Section 03 30 00 – Cast-in-Place Concrete
 - 2. Section 04 20 00 - Unit Masonry Assemblies
 - 3. Section 07 21 00 - Thermal Insulation

1.02 REFERENCES

- A. ASTM:
 - 1. D1187 - Asphalt-Base Emulsion Used as Protective Coatings for Metal
 - 2. D1227 - Emulsified Asphalt used as a Protective Coating for Roofing

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and application instructions, and maintenance recommendations.
- C. Material Certificates: For each product, signed by manufacturers.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

- B. Qualifications:
1. Manufacturer: 5 years experience in the manufacture of dampproofing.
 2. Contractor: 1 year experience in the installation of dampproofing.
 3. Personnel: For actual installation of dampproofing, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of Work.

1.05 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application in enclosed spaces. Maintain until Dampproofing has thoroughly cured.
- C. Existing Conditions: Inspect the project prior to installation; if conditions do not meet approval, notify architect. Proceeding without notification implies acceptance of conditions.
- D. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Asphalt Dampproofing:
1. Standard of Quality: Design is based on Hydrocide 700 by BASF, Minneapolis, MN www.basfbuildingsystems.com
 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Dehydratine 95 by Tamms Industries, Kirkland, IL www.tamms.com
 - b. 920AF by Karnak Corporation, Clark, NJ www.karnakcorp.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Emulsified Asphalt Dampproofing Compounds:
1. Heavy fibrated long fiber asphalt-emulsion dampproofing for application by trowel; complying with ASTM D1227, Type II, Class 1 and ASTM D1187, Type 1.
 2. VOC Content: Maximum 30 grams per liter.

- B. Dampproofing Accessories:
 - 1. Asphalt Emulsion Primer:
 - a. ASTM D1227, Type III, Class 1. Dilute with water as recommended by manufacturer.
 - b. Hydrocide 600 by BASF, Minneapolis, MN www.basfbuildingsystems.com non-fibrated asphalt emulsion; brush applied.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect, with applicator present, and verify that work is complete to point where this installation may properly commence, and for compliance with requirements for surface smoothness and other conditions affecting performance of work.
- B. Verification of Conditions: Verify that dampproofing may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection:
 - 1. Protect from rain during application and before dampproofing has set.
 - 2. Mask or otherwise protect adjoining exposed surfaces from staining, spotting, or coating with dampproofing.
 - 3. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Surface Preparation:
 - 1. Surface to be free of oil, grease, dirt, laitance, and loose material.
 - 2. Fill voids, seal joints, and apply bond breakers as recommended by prime material manufacturer.
 - 3. Dampen dry surfaces with water.
 - 4. Keep surface damp ahead of application.

3.03 APPLICATION

- A. Install dampproofing in strict accordance with manufacturers written recommendations.
- B. Prime Coat: Unless manufacturer's representative provides written permission to delete the prime coat, apply asphalt emulsion primer according to manufacturer's instructions.

- C. Mastic:
1. Trowel apply to thickness of 1/8 inch in strict accordance with manufacturer's recommendations, covering areas from vertical face of footing to grade line to prevent penetration of moisture through wall.
 2. Apply dampproofing to exterior face of footing and foundation wall. Dampproofing shall extend from bottom of exterior vertical face of footing up exterior face of foundation wall and over exterior veneer ledges.
 3. Dampproofing shall extend a minimum of 4-inches above finished grade.
 4. Fill in all crevices and grooves, making sure coating is continuous and free from breaks and pinholes.
 5. Spread around all joints, grooves and slots, and into all chases, corners, reveals and soffits.
 6. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
- D. Backfilling: After time recommended by manufacturer (minimum of 24 hours), place backfill in manner that will not rupture or damage dampproofing or protection course.

3.04 CLEAN UP

- A. Upon completion of work, remove scraps, waste, and debris from site. Remove misplaced dampproofing.

SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
1. Batt insulation.
 2. Blown insulation.
 3. Rigid insulation.
 4. Spray foam sealant.
 5. Vapor barrier (above grade).
 6. Accessories including, but not limited to:
 - a. Soffit vent chutes.
 - b. Tape.
 - c. Insulation support systems.
- B. The following is not included in this section:
1. Cavity wall insulation (Section 04 20 00).
 2. Sprayed Insulation (Section 07 21 29).
 3. Roof insulation at entry canopies (Section 07 54 00).
 4. Roof board insulation (Section 07 22 16).

- C. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete
 2. Section 04 20 00 - Unit Masonry Assemblies
 3. Section 06 10 00 - Rough Carpentry
 4. Section 07 21 29 - Sprayed Insulation
 5. Section 07 22 16 - Roof Board Insulation
 6. Section 07 53 23 - EPDM Membrane Roofing
 7. Section 07 84 00 - Firestopping
 8. Section 09 29 00 - Gypsum Board

1.02 REFERENCES

- A. ASTM:
1. C236 - Measuring Steady-State Thermal Transmission of Fenestration Systems
 2. C272 - Water Absorption
 3. C518 - Thermal Transmission
 4. C578 - Rigid Cellular Polystyrene
 5. C1304 - Odor Emission of Thermal Insulation Materials
 6. C1338 - Fungi Resistance of Insulation Materials and Facings
 7. D882 - Tensile Properties of Thin Plastic Sheeting
 8. D1621 - Compressive Properties
 9. D1709 - Impact Resistance of Plastic Film
 10. D2126 - Dimensional Stability
 11. E84 - Surface Burning Characteristics of Building Materials
 12. E96 - Water Vapor Transmission of Materials
 13. E119 - Fire Tests of Building Construction and Materials
 14. E136 - Behavior of Materials in a Vertical Tube Furnace

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements:
1. Plenum Rating: Provide insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 2. Mold Growth and Humidity Test Results: Insulation showing no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.04 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data:
 - 1. Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
 - 2. Include binders, additive, and expanding agent.
- C. Shop Drawings: Submit Shop Drawings showing system fabrication, installation drawings, including plans, elevations, sections details of components, joint locations and configurations within system and between system and adjoining system.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide building insulation system made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Regulatory Requirements:
 - 1. Use aged and settled values for thermal resistance factors (R-values), tested according to ASTM C518 at 75 degrees F and 50 percent relative humidity for at least 6 months.
 - 2. Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products by test method indicated below:
 - a. Surface-Burning Characteristics: ASTM E84.
 - b. Fire-Resistance Ratings: ASTM E119.
 - c. Combustion Characteristics: ASTM E136.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store and handle according to manufacturers recommendations.

1.07 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Batt/Blanket Insulation:

1. Fiberglass:
 - a. Standard of Quality: Design is based on products of Owens-Corning Fiberglass, Toledo, OH www.owenscorning.com
 - b. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - 1) CertainTeed, Valley Forge, PA www.certainteed.com
 - 2) Johns Manville www.jm.com
 - 3) Knauf Insulation, Shelbyville, IN www.knaufusa.com
 - 4) Manufacturer of comparable products meeting requirements of the specification.

B. Rigid Board Insulation:

1. Extruded Polystyrene:
 - a. Standard of Quality: Design is based on products of Owens Corning, Toledo, OH www.owenscorning.com
 - b. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - 1) Dow Chemical Company, Midland, MI
 - 2) Johns Manville www.jm.com
 - 3) Minnesota Diversified Products, Inc., Rockford, MN
 - 4) Pactiv Corporation, Atlanta, GA
 - 5) Manufacturer of comparable products meeting requirements of the specification.

C. Blown Insulation:

1. Standard of Quality: Design is based on products of Owens-Corning Fiberglass, Toledo, OH www.owenscorning.com
2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. CertainTeed, Valley Forge, PA www.certainteed.com
 - b. Johns Manville www.jm.com
 - c. Knauf Insulation, Shelbyville, IN www.knaufusa.com
 - d. Manufacturer of comparable products meeting requirements of the specification.

D. Spray Foam Adhesive/Sealant:

1. Standard of Quality: Design is based on Contech PL300 Foam Board Adhesive by Rexnord Chemical Products, Inc., Minneapolis, MN
2. Other acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. CF Crack and Joint Foam by Hilti, Tulsa, OK www.us.hilti.com
 - b. Maxbond by H.B. Fuller, Inc., Palatine, IL

- c. Pro-Series PR-225 by Ohio Sealants, Inc., Mentor, OH
 - d. Manufacturer of comparable products meeting requirements of the specification.
- E. Vapor Barrier:
 - 1. Standard of Quality: Design is based on products of Raven Industries, Sioux Falls, SD www.ravenind.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. Fortifiber Building Systems Group, Reno, NV www.fortifiber.com
 - b. Reef Industries, Houston, TX www.reefindustries.com
 - c. W.R. Meadows, Elgin, IL www.wrmeadows.com
 - d. Manufacturer of comparable products meeting requirements of the specification.

2.02 MATERIALS

- A. Batt Insulation:
 - 1. Glass Fiber Batts:
 - a. Unfaced, ASTM C 655, Type 1, preformed formaldehyde free glass fiber batt type insulation
 - b. Thermal resistance (R-Value): As noted on drawings but not less than R-19.
 - c. Combustion characteristics: Passes ASTM E136.
 - d. Flame spread less than 25, smoke development less than 50 per ASTM E84.
 - e. Critical radiant flux: ASTM E970, greater than 0.11 btu/square foot.
 - f. Water vapor sorption: ASTM C1104, 5 percent or less.
 - g. Odor emission: Passes ASTM C13047.
 - h. Corrosiveness: Passes ASTM C665.
 - i. Fungi resistance: Passes ASTM C1338.
 - j. Thickness: As recommended by manufacturer unless stated differently on Drawings.
 - k. Bi-component glass fiber: 2-part, irregularly twisted, glass fiber, not containing binders.
- B. Rigid Board Insulation:
 - 1. Use preformed units to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.
 - 2. Extruded Polystyrene Board Insulation:
 - a. Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by expansion of polystyrene base resin in extrusion process.
 - b. 5-year aged R-values (ASTM C518) 5.4 and 5 per inch at 40 and 5 degrees F respectively.
 - c. Dimensional stability (ASTM D2126) of 2.0 percent or less.
 - d. Water absorption (ASTM C272) of 0.10 percent (maximum).

- e. Below grade insulation:
 - 1) Product: Foamular 250.
 - 2) Type: IV.
 - 3) Minimum density: 1.6 pounds per cubic foot unless otherwise indicated.
 - 4) Compressive resistance: 25 pounds per square inch.
 - f. Above grade insulation:
 - 1) Product: Foamular 150.
 - 2) Type: X.
 - 3) Minimum density: 1.35 pounds per cubic foot unless otherwise indicated.
 - 4) Compressive resistance (ASTM D1621): 15 pounds per square inch.
- C. Blown (Loose Fill) Insulation:
 - 1. Fiberglass.
 - a. Thickness to provide R-value shown after insulation settles.
 - b. Type I, Category I, under ASTM C764.
 - c. Non-combustible under ASTM E136.
- D. Vapor Barrier:
 - 1. Continuous, skim reinforced layer laminated between two layers of polyethylene film (walls and ceiling).
 - 2. Thickness: 6 mils thick
 - 3. Permeance Rating: Maximum permeance rating of 0.1 perm
 - 4. Meet or exceed ASTM E-1745, Class C
 - 5. Product: Dura-Skrim 6 by Raven Industries.
- E. Accessories: All other materials not specifically described but required for complete and proper installation of building insulation, but not limited to:
 - 1. Soffit Vent Chute: Preformed polystyrene.
 - 2. Adhesive:
 - a. Product approved by insulation manufacturer.
 - b. Low VOC.
 - 3. Spray Foam Sealant: Non-shrink closed cell expanding urethane.
 - 4. Tape:
 - a. 2 inches wide.
 - b. Self-adhesive vapor barrier tape.
 - c. Flame spread index of 25 or less, smoke developed index of 50 or less.
 - 5. Insulation Supports:
 - a. Corrugated cardboard for overhead installations, 65 percent recycled content, foil facing.
 - b. Netting for blown-in insulation in wall and ceiling cavities.

- c. Screw attached spindle-type anchors:
 - 1) Perforated plate welded to projecting spindle.
 - 2) Plate galvanized carbon steel.
 - 3) Spindle copper-coated, low carbon steel, fully annealed, 12 gage tip. Length to suit depth of insulation.
- d. Metal or wire strapping.

2.03 ENVIRONMENTAL CONSIDERATIONS

- A. Chemical Composition:
 - 1. Rigid board insulation shall not contain chlorofluorocarbons (CFCs).
 - 2. Insulation shall not contain formaldehyde.
- B. Seal insulation products containing loose fiber or chemicals that offgas, from office spaces.
- C. Protect ducts and HVAC system from loose insulation particulates.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades:
 - 1. Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
 - 2. Verify substrates are properly prepared and clean.
- B. Verification of Conditions: Verify that building insulation may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies:
 - 1. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 2. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. General:
 - 1. Install according to manufacturer's instructions.
 - 2. Where taped joints are specified, completely seal joints between adjacent vapor barriers and between vapor barriers and adjacent construction.
 - 3. Water-piping coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
 - 4. Install insulation that is undamaged, dry, and unsoiled, and that has not been left exposed at any time to ice and snow.
 - 5. Minimize the generation of offcuts and waste. Reuse insulation scraps to maximum extent feasible.

- B. Batts/Blankets:
 - 1. Install snug fitting to completely fill cavities, without voids.
 - 2. Fill voids around windows, door frames, and miscellaneous exterior openings.
 - 3. Fit to exterior side of electrical devices and pipes.
 - 4. Fasten to vertical surfaces using 9/16 inch staples.
 - 5. Do not compress to fit.
- C. Rigid Board Insulation:
 - 1. Install in a clean, dry condition.
 - 2. Attach with adhesive or mechanical anchors specifically recommended for such use.
 - 3. Use expanding foam sealant between insulation panels.
 - 4. Fill holes and openings.
- D. Blown Insulation: Allow settlement to proper thickness for specified R-value.
- E. Vapor Barrier: Comply with ASTM E1643.
 - 1. Walls:
 - a. Apply full height continuous vapor barrier over warm side face of studs.
 - b. Temporarily attach to ceiling deck with tape or other suitable material until interior covering is applied.
 - c. Where necessary to lap vapor barrier, lap minimum 2 stud spaces and tape.
 - 2. Ceiling:
 - a. Underside of ceiling framing:
 - 1) Apply continuous vapor barrier with minimum number of lap joints over warm side face of framing.
 - 2) Temporarily attach to ceiling framing with tape or other suitable material until interior covering is applied.
 - 3) Where necessary to lap vapor barrier, lap minimum 2 stud spaces and tape.
 - 3. Roof Deck:
 - a. Apply continuous vapor barrier with minimum number of laps on roof deck prior to installation of insulation.
 - b. Where necessary to lap vapor barrier, lap minimum of 6 inches and tape.
 - 4. Seal joints caused by pipes, conduits, electrical boxes, windows, doors, curtainwalls and similar items penetrating vapor barriers with vapor-barrier tape to create an airtight seal between penetrating objects and vapor barrier.
 - 5. Electrical Boxes: After installation of electrical boxes, conduit, and wires, coat entire surface of exterior of electrical box with 1-inch (minimum) of spray foam insulation.
 - 6. Repair any tears or punctures in vapor barriers immediately before concealment by other work. Cover with vapor barrier tape or another layer of vapor barrier.

- F. Other Insulation: Apply as indicated on Drawings or required by construction in such a manner to provide continuous barrier to movement of heat and air.
- G. Soffit Vent Chute:
 - 1. Install chute in each end of truss space.
 - 2. Staple chute to each side of truss.
 - 3. Turn chute down and staple to sill plate to ensure insulation does not filter into soffit.
 - 4. Chute shall extend to allow full thickness of insulation to be placed in attic space without interfering with attic ventilation.
 - 5. Multiple chutes may be needed to ensure coverage.

3.03 PROTECTION

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

3.04 INSPECTION AND TESTING

- A. Inspect insulation for proper installation.
- B. Correct defects such as voids, gaps, or insulation compressed behind pipes.

3.05 CLEANING

Clean construction area of all scrap insulation at the end of each working day

SECTION 07 21 29 - SPRAYED INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Provide seamless sprayed-in-place 2 component polyurethane foam (PUF) building envelope insulation system, including:
 - 1. Polyurethane foam insulation.
 - 2. Thermal Barrier.
 - 3. Primer.
 - 34 Accessory items.
- B. Related Sections:
 - 1. Section 04 20 00 – Unit Masonry Assemblies
 - 2. Section 06 10 00 – Rough Carpentry

3. Section 06 17 53 – Shop-Fabricated Wood Trusses
4. Section 07 21 00 - Thermal Insulation

1.02 REFERENCE

- A. ASTM:
 1. C1029 - Standard Specification for Spray-Applied Rigid Polyurethane Thermal Insulation
 2. E96 - Water Vapor Transmission

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, MSDS, handling, storage and installation instructions, and maintenance and cleaning recommendations.
- C. Quality Assurance/Control Submittals:
 1. Test Reports: From independent testing laboratories indicating compliance of materials with the performance requirements.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide materials made of components, with uniform texture and color or blend, furnished by 1 manufacturer for each different product required.
- B. Qualifications:
 1. Manufacturer: 5 years experience in the manufacture of foamed-in-place insulation, with 6 projects of similar size, scope and type of which 3 have been in successful use for 3 years or longer.
 2. Contractor: 3 years experience in the installation of foamed-in-place insulation.
 3. Installers: For actual installation of sprayed insulation, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

1.05 WARRANTY

- A. Provide manufacturer's limited lifetime warranty to repair or replace defective product.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Acceptable Manufacturers: Basis of design is based on CertaSpray Closed Cell Foam as manufactured by Certainteed.
- B. Acceptable alternate manufacturers and products are:
1. *Icynene Insulation System* by Icynene www.icynene.com
 2. BASF www.basf.com/urethanechemicals
 3. Manufacturer of comparable products submitted in compliance with Division 01 and having an ICC ES ESR Certification indicating thermal barrier is approved when applied over selected spray foam insulation.

2.02 MATERIALS

- A. Polyurethane Foam:
1. 2-component system made by combining an isocyanate (A) component with a polyol (B) resin component, possessing the following physical characteristics:
 - a. Dust-free.
 - b. Contains no ozone depletion chemicals, no formaldehyde, no asbestos.
 - c. Passes established off-gassing tests.
 - d. Will not cause corrosion when in contact with steel.

Closed Cell Type

Properties	ASTM Test	US Units
Density (sprayed-in-place)	D1622	1.5-3.0 lbs/ft ³
Compressive Strength	D1621	15 lb/in ² (minimum)
R-Value per inch	C177, C236, C518	6.2° F ft ² hr/Btu average aged value
Closed Cell Content	D2856	90% (minimum)
Flammability (FSI)	E84	75 or less
Smoke	E84	450 or less, smoke developed rating
Water Absorption (percent by volume)	D2842	1.0 - 2.0
Water Vapor Permeance at 2-inches	E96	< 1 Perm at 2 inch thickness

- B. 15-minute-rated Thermal Barriers:
1. Compatibility: Thermal barrier must have an ICC ES ESR Certification indicating thermal barrier is approved when applied over spray foam insulation.
 2. Install in strict accordance with manufacturers written instructions.
 3. Material: Waterbased, non-toxic, resinous material that can be spray, brushed or roller applied.

4. Thickness: As recommended by manufacturer to achieve thermal barrier.
 5. Product: FlameSeal-TB by Flame Seal Products, Inc.
- C. Substrate Primers (if required): Select for the substrate to be primed and be compatible with spray polyurethane foam.
1. Wood: chlorinated rubber, modified alkyds, others.
 2. Steel: modified alkyds, epoxy, acrylics, others.
 3. Galvanized: vinyl copolymer, "wash primer," modified alkyds, others.
 4. Concrete/Masonry: chlorinated rubber, vinyl copolymer acrylic, asphaltic, other.
- D. Other materials not specifically described but required for complete, proper installation of sprayed insulation, subject to acceptance of architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that sprayed insulation may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protect installed work and materials of other trades.
- B. Provide suitable coverings to prevent overspray from coming into contact with unintended fixtures and surfaces.
- C. Sequence application so as to take into consideration substrate preparation, proper cure times, and inter-coat adhesion.
- D. Substrate Preparation: Surfaces free of loose scale, rust, weathering, chalking paint, dirt, petroleum-based grease and oil, or other contaminants that would impair bonding.

3.03 INSTALLATION

- A. Comply with manufacturer's Product Data, including product technical bulletin installation instructions and details and ASTM D5469.

- B. Primer:
 - 1. Achieve minimum thickness of dry mils.
 - 2. Cure: 24 hours or as recommended by manufacturer of spray polyurethane foam.
- C. Spray Polyurethane Foam:
 - 1. Mix components A and B in strict accordance with manufacturer's instructions.
 - 2. Follow manufacturer's guidelines for temperature, humidity, and other atmospheric conditions.
 - 3. Spray in minimum 1/2-inch-thick passes (lifts) with the overall thickness to be a minimum of 3-inches.
 - 4. Complete full thickness of spray polyurethane foam to be applied within any given area in 1 day.
- D. Thermal Barrier:
 - 1. Cover interior surface of the spray polyurethane foam, where not covered with gypsum board, with a 15-minute rated thermal barrier.
 - 2. Apply thermal barrier according to manufacturer guidelines.

3.04 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from Work of this Section. Maintain premises in neat, orderly condition.
- B. System:
 - 1. Remove temporary covering and other provisions made to minimize soiling of other work.
 - 2. Promptly clean surfaces not to receive spray insulation; repair surfaces stained, marred or otherwise damaged during Work.
 - 3. When Work is completed, remove unused materials, containers, equipment, and debris.

3.05 WASTE MANAGEMENT

- A. Comply with manufacturer's guidelines and regulatory agencies for proper disposal of waste materials and containers.

3.06 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer to ensure work is without damage or deterioration at time of Substantial Completion.

SECTION 07 22 16 - ROOF BOARD INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Provide nail base rigid board insulation and accessories.
- B. Related Sections:
 - 1. Section 06 10 00 – Rough Carpentry
 - 2. Section 06 17 53 – Shop-Fabricated Wood Trusses
 - 3. Section 07 41 13 - Metal Roofing and Wall Panels
 - 4. Section 07 46 17 – Metal Soffit and Fascia Systems

1.02 REFERENCES

- A. ASTM:
 - 1. C1289 - Standard for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - 2. D2842 - Water Absorption of Rigid Cellular Plastics

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements: Materials of this Section shall provide continuity of thermal barrier at building enclosure elements.

1.04 SUBMITTALS

- A. Provide submittals according to Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage, and installation instructions, and maintenance and cleaning recommendations.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide nail base rigid board insulation units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of nail base rigid board insulation, with 6 projects of similar size, scope, and type of which 3 have been in successful use for 3 years or longer.
 - 2. Personnel: For actual installation of nail base rigid board insulation, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, and thoroughly familiar with requirements of work.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Do not install insulation adhesives when manufacturer's recommendations indicate temperature or weather conditions are detrimental to successful installation.
- B. Existing Conditions: Drawings to not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Nail Base Rigid Board Insulation:
 - 1. Acceptable Manufacturers: Design is based on Vent-Top ThermaCal 1 as manufactured by Cornell Corporation www.cornellcorporation.com, Atlas Roofing Corporation (www.atlasroofing.com)
 - a. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Nail Base Rigid Board Insulation:
 - 1. Composite vented panel consisting of a polyisocyanurate foam bonded to APA performance rated 7/16 inch OSB board with a vented air space between them.
 - 2. Thickness: As indicated on Drawings.
 - 3. Air Space: Minimum 1-inch air space.
 - 4. Spacer Blocks: 2-inch wood spacer blocks space not more than 12-inches apart
 - a. Spacers shall not exceed 8-percent of panel area.
 - b. Panel air space shall have a minimum of 50-percent open area for lateral (across the slope) ventilation
 - 5. LTTR-Value: Minimum R-25.
 - 6. Panel Edge Profile: Tongue and groove insulation joints.
 - 7. Meet ASTM C1289 and D2842 requirements.
- B. See section 07 21 00 for roof vapor barrier.
- C. Accessories:
 - 1. Fasteners: Provide mechanical fasteners per manufacturers recommendation for attachment to structural roof deck and framing.
 - 2. Adhesive: Type recommended by insulation manufacturer for application.
 - 3. Tape: Bright aluminum self-adhering type, 2 inches wide.
 - 4. Other Materials: Materials not specifically described but required for complete, proper installation of nail base rigid board insulation, subject to acceptance of architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to the point where this installation may properly commence.
- B. Verification of Conditions:
 - 1. Verify that nail base rigid board insulation may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
 - 2. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.
 - 3. Verify substrate is flat, free of honey comb, fins, irregularities, and materials or substances that may impede adhesive bond.
- C. Discrepancies: Immediately notify architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection: Protect installed work and materials of other trades.
- B. Verify roof framing, decking, and vapor barrier has been installed in acceptable fashion and roof is ready to receive roof board insulation prior to beginning installation.

3.03 INSTALLATION

- A. Manufacturer's Instructions:
 - 1. Install nail base rigid board insulation as recommended by manufacturer.
- B. Nail Base Rigid Board Insulation:
 - 1. Fasten roof board insulation to wood deck with self-drilling mechanical fasteners. Extend fasteners through roof board insulation and directly into structural roof decking or framing space fasteners as recommended by panel manufacturer.
 - 2. Stagger end joints.
 - 3. Butt tongue and groove edges and ends tight to adjacent board and to protrusions to create a continuous insulation barrier.
 - 4. Cut back panels as shown on drawings at ridge and eaves to allow for free flow of ventilation air through panel air space.
- C. Tape: Seal all joints.

3.04 REPAIR/RESTORATION

- A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials and procedures recommended or furnished by manufacturer.

3.05 ADJUSTING

- A. Replace damaged materials with new materials complying with specified requirements.

3.06 CLEANING

- A. Site: Do not allow accumulation of scraps, or debris arising from work of this section. Maintain premises in a neat, orderly condition.
- B. System:
 - 1. Remove temporary covering and other provisions made to minimize soiling of other work.
 - 2. Promptly clean surfaces not to receive adhesive; repair surfaces stained, marred, or otherwise damaged during work.
 - 3. When work is completed, remove unused materials, containers, equipment, and debris.

3.07 PROTECTION

- A. General: Provide final protection and maintain conditions, in a manner acceptable to manufacturer to ensure work is without damage or deterioration at time of Substantial Completion.

SECTION 07 27 00 - AIR BARRIERS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Fluid-applied membrane air barriers.
 - 2. Air barrier accessories.
- B. Related Sections:
 - 1. Section 04 20 00 - Unit Masonry Assemblies
 - 2. Section 04 43 00 - Stone Masonry
 - 3. Section 06 10 00 - Rough Carpentry
 - 4. Section 07 21 00 - Thermal Insulation
 - 5. Section 07 11 13 – Bituminous Damproofing
 - 6. Section 07 92 00 - Joint Sealants

1.02 REFERENCES

A. ASTM:

1. C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
2. ASTM C1193 Guide for Use of Joint Sealants
3. ASTM D412 Standard Test Methods for Rubber Properties in Tension
4. ASTM D570 Test Method for Water Absorption of Plastics
5. ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
6. ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
7. ASTM D1876 Test Method for Peel Resistance of Adhesives
8. ASTM D1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting
9. ASTM D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
10. ASTM D4258 Practice for Surface Cleaning Concrete for Coating
11. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
12. ASTM E96 Test Methods for Water Vapor Transmission of Materials
13. ASTM E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
14. ASTM E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems
15. ASTM E2178 Standard Test Method for Air Permeance of Building Materials
16. ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Provide a continuous air barrier system.
2. Minimize condensation within assembly.
3. Drain water directly to exterior where likely to penetrate components in the wall assembly.
4. Join air barrier in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Make connection between:
 - a. Foundation and walls.
 - b. Walls and windows or doors.
 - c. Different wall systems.
 - d. Wall and roof.
 - e. Wall and roof over unconditioned space.

- f. Walls, floor, and roof across construction, control and expansion joints.
 - g. Walls, floors, and roof to utility, pipe, and duct penetrations.
- B. Performance Requirements:
 - 1. Fire Resistive Air Barrier: Flame spread 19 and smoke developed 44 per ASTM E84.
 - 2. Freeze/Thaw Resistance: ICBO Method with no visible effects of cracking, checking, delamination, or erosion at magnification of 5.
 - 3. Meet ASTM E2357 for entire air barrier assembly.

1.04 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance and cleaning recommendations.
- C. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction. Show a continuous plane of air tightness throughout the building envelope.
- D. Quality Assurance/Control Submittals:
 - 1. Test Reports: Submit documentation from an approved independent testing laboratory certifying that air leakage and vapor permeance rates, including primary membrane and transition sheets, exceed the requirements of the state energy code.
 - 2. Certificates:
 - a. Manufacturer's ISO certification.
 - b. Product: Certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with air barrier, signed by product manufacturer.
 - c. Certifications: Provide to Engineer, certification of installer from manufacturer of air barrier.
- E. Maintenance Manual: Provide to owner, maintenance and warranty data in "Maintenance Manual" at Maintenance Demonstration at Substantial Completion.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide air barriers and components furnished by one manufacturer as coordinated assemblies.

- B. Qualifications:
1. Manufacturer: 5 years experience in the manufacture of air barriers, with 6 projects of similar size, scope and type of which 3 have been in successful use for 3 years or longer. ISO certified.
 2. Contractor: 3 years experience in the installation of air barrier.
 3. Applicator: Provide written approval by manufacturer.
- C. Regulatory Requirements: Verify compliance of fluid-applied air barrier materials with applicable code via an evaluation report.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements:
1. Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a wet substrate or during snow, rain, fog, or mist.
- B. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 WARRANTY

- A. Provide manufacturer's standard 5-year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Fluid-Applied Membranes:
1. Air Barriers:
 - 1) Standard of Quality: Design is based on products as manufactured by W.R. Grace, Minnetonka, MN www.graceconstruction.com, Henry Air Barriers (www.us.henry.com)
 - b. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - 1) Manufacturer of comparable products meeting requirements of specifications.

2.02 FLUID-APPLIED MEMBRANE

- A. Air Barrier- Synthetic Rubber (non-permeable):
1. Liquid air barrier.
 2. 2-part, self-curing, synthetic rubber based adhesive With Following characteristics:
 - a. Wet film thickness of 120 mils, 60 dry mils per ASTM D 3767.
 - b. Air Permeance: 0.0002 cfm/sq. ft. under 1.57 psf pressure differential (ASTM E2178).

- c. Vapor Permeance: 0.08 perms (ASTM E96, method B).
 - d. Peel Adhesion: 18 psi to glass faced wall board. (ASTM D4541).
 - e. Product: Perm-a-Barrier Liquid as manufactured by W.R. Grace.
- B. Transition and Wall Flashing Membrane:
 - 1. Self-adhered rubberized asphalt bonded to cross laminated polyethylene film.
 - 2. Thickness: 40-mils.
 - 3. Water vapor transmission: 0.05 perms (ASTM E96).
 - 4. Product: Perm-A-Barrier Detail Membrane or as recommended by air barrier manufacturer.
- C. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, low modulus silicone sealant for bonding extrusions to substrates.
- D. Primer:
 - 1. Water based, no solvent odors.
 - a. Product:
 - 1) Perm-A-Barrier WB Primer by Grace Construction Products.
 - b. Use in temperatures above 45 degrees F.
- E. Liquid air seal mastic and insulation adhesive:
 - 1. Product:
 - a. Bituthene Liquid Membrane by Grace Construction Products.
 - 2. Synthetic, trowel applied, rubber based adhesive.
 - 3. Compatible with air/vapor barrier membrane, substrate, and insulation.
 - 4. Resistant to alkalis and salt.
- F. Other Materials: Materials not specifically described but required for complete, proper installation of air barrier, subject to acceptance of Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that air barrier system may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

A. Protection:

1. Protect installed work and materials of other trades.
2. Protect air barrier from exposure to UV light and harmful weather exposure. Remove and replace air barrier exposed to these conditions for more than 30 days.
3. Apply within manufacturer's recommended application temperature ranges.

B. Surface Preparation:

1. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied waterproofing.
2. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 2-3 inch wide, reinforced self-adhesive tape or fiberglass mesh style wallboard tape. Gaps greater than 1/4 inches should be filled with mastic or caulk, allowing sufficient time to fully cure before application of the tape and fluid applied membrane.
3. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth flush mortar joints. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.

3.03 INSTALLATION

A. Seal joints with tape or sealant.

B. Primer:

1. Apply primer at rate recommended by manufacturer.
2. Apply primer to all areas to receive transition or air barrier membrane sheet and through-wall flashing membrane.
3. Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Fill gaps with foam sealant.
4. Primed surfaces not covered by transition membrane or through-wall flashing membrane during same working day must be re-primed.

C. Transition Sheet/Strips:

1. Position self-adhered transition membrane and remove protective film. Press firmly into place.
2. Ensure minimum 2-inch overlap at all end and side laps.
3. Promptly roll all laps with a counter top roller to effect seal.
4. Repair punctures, voids, and deficient lapped seams in transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.
5. Ensure preparatory work is complete prior to installing air barrier.
6. Ensure continuity of air barrier with roofing membrane.

- D. Through-wall Flashing Membrane (Self-Adhering):
1. Align and position the leading edge of membrane with the front horizontal edge of foundation walls or self angles.
 2. Partially remove protective film and roll membrane over surface and up vertically.
 3. Press firmly into place.
 4. Ensure minimum 2-inch overlap at all end and side laps.
 5. Promptly roll all laps and membrane to effect the seal.
 6. Ensure membrane extends fully to exterior face of exterior masonry veneer. Trim off excess as directed by manufacturer's representative.
 7. Apply membrane along the base of masonry veneer walls, over windows, doors, and all other wall openings.
 8. Membrane shall form continuous flashing and shall extend a minimum of 8 inches up the back-up wall.
- E. Air Barrier (non- permeable) Installation:
1. Spray apply a continuous uniform film at min. 60 mil dry film thickness using multiple, overlapping passes.
 2. When spraying use a cross-hatching technique (alternating horizontal and vertical passes) to ensure even thickness and coverage.
 3. When spraying use high pressure, multi-component, airless spray equipment approved by material manufacturer.
 4. Carry membrane into any openings a minimum of 2 in.
 5. Seal all brick-ties and other penetrations as work progresses.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections:
1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed.
 7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Air barrier has been firmly adhered to substrate.
 10. Compatible materials have been used.

11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

3.05 REPAIR/RESTORATION

- A. Repair punctures, voids, and deficient lapped seams. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches beyond repaired areas in all directions.
- B. Use materials, procedures recommended or furnished by manufacturer.
- C. Remove and replace tested deficient air barrier components and retest.

3.06 CLEANING

- A. Site:
 1. Do not allow accumulation of scraps, debris arising from work of this section. Remove empty containers, rags, and rubbish daily from site.
 2. Maintain premises in neat, orderly condition.
- B. System:
 1. Remove temporary covering and other provisions made to minimize soiling of other work.
 2. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

3.07 PROTECTION

- A. Protect air barrier from exposure to UV light and harmful weather exposure.
- B. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer to ensure work is without damage or deterioration at time of Substantial Completion.

SECTION 07 41 13 - METAL ROOFING AND WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Standing Seam Roofing Panels.
 - 2. Soffit and Fascia Panels and Trim.
 - 3. Concealed Fastener Wall Panels (canopy).
 - 4. Flashings and trim.
 - 5. Water barrier membrane (membrane underlayment).
 - 6. Miscellaneous accessories including, but not limited to:
 - a. Gaskets.
 - b. Panel clips.
 - c. Fasteners.
 - d. Joint sealers for metal roof and wall panels.
 - e. Snow guards.
 - f. Ridge Vent
 - g. Rosin Paper
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry
 - 2. Section 06 17 53 – Shop-Fabricated Wood Trusses
 - 3. Section 07 22 16 - Roof Board Insulation
 - 4. Section 07 53 23 - EPDM Membrane Roofing
 - 5. Section 07 62 00 - Sheet Metal Flashing and Trim
 - 6. Section 07 92 00 - Joint Sealants

1.02 REFERENCES

- A. ASTM:
 - 1. A653 - Galvanized Steel Sheet by Hot Dip Process
 - 2. B209 - Aluminum Alloy Sheet
 - 3. C209 - Cellulostic Fiber Insulation Board
 - 4. D226 - Asphalt Saturated Organic Felt
 - 5. D523 - Specular Gloss Coatings
 - 6. D1970 - Self-Adhering Polymer Modified Bituminous Sheet Materials
 - 7. E119 - Methods for Fire Tests of Building Construction and Materials
 - 8. E136 - Combustion Characteristics
 - 9. E1592 - Structural Performance
 - 10. E1646 - Water Penetration
 - 11. E1680 - Air Leakage
- B. NAAMM - “Metal Finishes Manual for Architectural and Metal Products”

1.03 SUBMITTALS

- A. Provide submittals according to requirements of Division 01.
- B. Product Data: Manufacturer's current product specifications, standard details, certified product test results, installation instructions, general recommendations, as applicable to materials and finishes for each component and for total system of preformed panels.
- C. Samples:
 - 1. Manufacturer's standard color samples.
 - 2. Three weeks (minimum) prior to fabrication/delivery, 2 copies, 12 inches square, of each exposed finish material, including joint.
- D. Shop Drawings:
 - 1. Small-scale layouts of panels, large-scale details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim flashings, closures, special details including side laps and end laps if any.
 - 2. Distinguish between factory and field assembly work.
 - 3. Coordination Drawings of roof or wall plans for metal panels, coordinating penetrations and roof-mounted or wall-mounted items.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide materials made of components with uniform texture and color or blend, furnished by 1 manufacturer unless indicated otherwise.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of metal roof and wall panels.
 - 2. Contractor: 3 years experience in the installation of metal roof and wall panels.
 - 3. Testing and Inspection Agency: ASTM E119, acceptable to authorities having jurisdiction.
- C. Regulatory Requirements:
 - 1. Fire-Resistance Ratings:
 - a. Combustion characteristics: ASTM E136.
 - b. Comply with UL "Fire Resistance Directory".
 - c. Identify panels with markings of testing and inspecting agency.
 - d. Surface-burning characteristics:
 - 1) Flame spread index: 25 or less.
 - 2) Smoke-developed index: 450 or less.
 - 2. Meet IBC code requirements adopted by state in which project is located.
 - 3. Low slopped roofs: Design to resist uplift pressure calculated according to ANSI/SPRI ES 1.

4. Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for the following:
 - a. Metal panels:
 - 1) Air infiltration: ASTM E283 and E1680.
 - 2) Water penetration: ASTM E331 and E1646.
 - 3) Wind-uplift resistance: UL 580.
 - 4) Structural performance: ASTM E330 and E1592.
- D. Manufacturer's Observation:
 1. Manufacturer's representative shall visit site while panels are being installed to observe methods.
 2. Manufacturer's representative shall submit log of visit, including instructions given to the installer, to the E/A's office within 1 week of visit.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect metal panels from damage (including rust) during shipment, storage, and construction.
- B. Stack on platforms or pallets, covered with suitable weather-tight and ventilated covering. Ensure dryness.

1.06 PROJECT CONDITIONS

- A. Existing Conditions:
 1. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.
 2. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

1.07 COORDINATION

- A. Coordinate metal panel assemblies with adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.08 WARRANTY

- A. Manufacturer:
 1. Provide 20-year warranty for paint.
 2. Provide 20-year weather tightness warranty against leaks of the roof in writing, to be repaired or replaced at no cost to owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Roofing, Wall, Soffit and Fascia and Trim Panels: Standard of Quality: Design is based on products of Firestone Metal Products www.unaclad.com, Grace Construction Products (www.graceconstruction.com)
 - 1. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Metal Sales Manufacturing Corporation, Louisville, KY www.metalsales.com
 - b. Berridge Manufacturing, San Antonio, TX www.berridge.com
 - c. Centria www.centria.com
 - d. PAC-CLAD Peterson Aluminum, Elk Grove, IL www.pac-clad.com
 - e. Manufacturer of comparable products meeting requirements of specifications.
- B. Water Barrier Membrane: Standard of Quality: Design is based on Clad-Guard as manufactured by Firestone Metal Products www.unaclad.com
 - 1. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Manufacturer of comparable products meeting requirements of specifications and approved as a roofing underlayment by standing seam metal roof supplier.

2.02 MATERIALS

- A. Aluminum:
 - 1. Compliant with ASTM B209.
- B. Steel for Painting/Coating:
 - 1. G90 hot-dip zinc coated steel sheet compliant with ASTM A653, Grade A except where higher strength required by manufacturer for performance.
- C. Water Barrier Membrane:
 - 1. ASTM D1970.
 - 2. 36-inch-wide, 0.004-inch thick.
 - 3. Cold-applied, self-adhering membrane.
 - 4. High-strength polyethylene film coated on one side with a thick layer of adhesive-consistency rubberized asphalt.
 - 5. Membrane to be able to withstand temperature of 200 degrees F without adhesive degradation.
 - 6. Provide complete with manufacturer's recommended primer.

2.03 FABRICATION

A. General:

1. Fabricate panels to sizes on Drawings.
2. Form siding panels with preformed corners fully welded and ground smooth.
3. Fabricate and finish panels, accessories, at factory to greatest extent possible by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements which have been demonstrated by factory testing.
4. Form panels to specified dimensions with tolerances to accommodate thermal expansion and contraction between panels and structural members.
5. Fabricate panel joints with captive gaskets or separator strips, which provide tight seal and prevent metal-to-metal contact in manner to minimize noise from movements within panel system.
6. Condensation: Fabricate panels for control of condensation, including vapor inclusion of seals and provisions for breathing, venting, weeping, and draining.
7. Comply with indicated profiles and dimensional requirements, and structural requirements.

B. Panels:

1. (Architectural) Standing Seam Roofing:
 - a. 24 gauge steel.
 - b. UL-90 rating.
 - c. 20-inch-wide panel with 1-1/2 inch rib.
 - d. Product: Una-Clad UC-3.
 - e. Color: Slate Gray.
2. Fabricated Plate Panels:
 - a. Aluminum.
 - b. Provide plate system with 0.875 inch full perimeter flange and welded corners.
 - c. Metal thickness: 0.125 inch.
 - d. Fabricate panels to allow removal of individual panels without disturbance of adjoining panels.
 - e. Splice plates are to be welded to one side of panel.
 - f. Include clip angles, joint sealant, and accessories recommended by the manufacturer.
 - g. Sealant: Provide joint sealants between panels as recommended by manufacturer to ensure watertight system.
 - h. Product: Una-Clad Series 3000UC..
 - i. Color: Slate Gray.
3. Soffit Panels:
 - a. Provide factory-formed vented and non-vented panels designed to be field-assembled by lapping and interconnecting side edges of adjacent panels and mechanically attach to panel through supports, using concealed fasteners in side laps.

- b. Factory-apply sealant within interlocking joint.
- c. Fabricate in lengths as long as possible.
- d. Width: 20-inches.
- e. Material: Aluminum.
- f. Product: Una-Clad UC-500 (flush).
- g. Color: Slate Gray.
- 4. Flashing, Fascia and Trim:
 - a. Form fascia panels and trim to match profiles shown.
 - b. J channel and all closure trim indicated as required for complete system.
 - c. Materials: Minimum 0.063 inch thick Aluminum
 - d. Locations as shown on Drawings or otherwise required to make building watertight.
 - e. Color: Slate Gray
- 5. Accessories: Including but not limited to:
 - a. Gaskets: As provided by metal panel manufacturer.
 - b. Panel clips:
 - 1) As recommended by panel manufacturer.
 - 2) 16 gage minimum.
 - 3) Full recessed to prevent sharp edges coming into contact with roof materials.
 - 4) Allow for expansion and contraction of panel through expected temperature range.
 - c. Fasteners:
 - 1) Screw type.
 - 2) As recommended by panel manufacturer.
 - 3) Stainless steel.
 - 4) Separate washers with hot bonded neoprene faces and pop rivets set in wet sealant.
 - d. Joint sealers: As recommended by panel manufacturer or, if not specified, see Section 07 92 00.
 - e. Slip sheet: Red rosin paper, minimum 5 pounds per 100 square feet.
 - f. Snow guards: Provide snow guards recommended by roofing panel.
 - g. Ridge Vent: Provide ridge vent as recommended by roofing panel. Free area to account for minimum of 50% of the required venting of attic or roof space.

2.04 METAL FINISHES

- A. General Requirements:
 - 1. Apply coatings either before or after forming and fabricating panels, as required by coating process and for maximum coating performance capability.
 - 2. Protect coating promptly after application and cure, by application of strippable film or removable adhesive cover. Retain until installation has been completed.
 - 3. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products."

- B. Paint:
 - 1. Fluoropolymer Coating: Full-strength 70 percent Kynar 500 coating baked-on for 15 minutes at 450 degrees F in dry film thickness of 1.0 mil, 30 percent reflective gloss (ASTM D523), over minimum 0.2 mil baked-on modified epoxy primer.
 - 2. Siliconized Polyester Finish:
 - a. Total dry film thickness:
 - 1) Exterior: 1 mil.
 - 2) Interior: 0.5 mil.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that metal panels may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies:
 - 1. Immediately notify E/A in writing.
 - 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 3. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protect installed work and materials of other trades.
- B. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials which are incompatible or could result in corrosion or deterioration of either material or finishes.

3.03 INSTALLATION

- A. Water Barrier Membrane: Lay one layer horizontally over entire roof and wall; lapping according to manufacturer's written instructions.
- B. Roofing, Wall and Soffit Panels:
 - 1. Comply with panel fabricator's and material manufacturers' instructions for installation, as applicable to project conditions and supporting substrates.
 - 2. Field cutting by torch is not permitted.
 - 3. Anchor panels and other components of work securely in place, with provisions for thermal/structural movement.
 - a. Install panels with recommended fasteners.
 - b. Separate dissimilar metals with bituminous paint, PVC shims, or separation tape/membrane wherever 2 dissimilar metals come in contact.

- C. Fabricated Plate Panel:
 - 1. Attach panels with intermittent, staggered clip angles.
 - 2. Install with nominal 1/2-inch joints.
 - 3. Seal joints to ensure water tight system.
- D. Metal Soffit Panels:
 - 1. Install as indicated on Drawings, or if not indicated, perpendicular to support framing.
 - 2. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
- E. Accessories
 - 1. Snow Guards:
 - a. Install snow guards above traffic areas (entrances, exits) as indicated on Drawings.
 - b. Install as recommended by manufacturer in manner acceptable by panel manufacturer.
 - c. Do not use fasteners that penetrate metal panels.
 - d. Fence style snow guards with clamps anchored to standing seams.
 - e. Material: Aluminum.
 - f. Color: Match standing seam metal roof color.
 - g. Product: SnowMax Standing Seam as manufactured by Alpine Snowguards.
 - 2. Joint Sealers:
 - a. Install gaskets, joint fillers, sealants where indicated and where required for weatherproof performance of panel systems.
 - b. Provide types of gaskets, sealants/fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.
 - 3. Rooftop Equipment Crickets: Provide panel manufacturer's standard cricket to flash rooftop equipment and provide positive drainage.

3.04 FIELD QUALITY CONTROL

- A. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet on level/plumb/slope and location/line as indicated, within 1/8 inch offset of adjoining faces and of alignment of matching profiles.
- B. Owner may engage a qualified independent testing and inspecting agency to perform inspections and prepare reports.
- C. Engage a factory-authorized service representative to inspect completed metal panel installation, including accessories, and provide written report.
- D. Remove and replace metal panels that inspections indicate do not comply with specified requirements.
- E. Additional inspections, at contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 CLEANING AND PROTECTION

- A. Replace panels, other components of work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.
- B. Cleaning:
 - 1. Remove temporary protective coverings and strippable films, if any, as each panel is installed.
 - 2. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer.
 - 3. Maintain clean condition during construction.
- C. Protection: Maintain conditions in a manner acceptable to manufacturer to ensure work is without damage or deterioration at time of Substantial Completion.

SECTION 07 46 33 - PLASTIC SIDING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Vinyl Lap Siding.
 - 2. Vinyl siding accessories including, but not limited to:
 - a. Starter strips.
 - b. Siding corners.
 - c. Door and window casing.
 - d. Fasteners.
 - e. Weather Resistant Barrier.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry
 - 2. Section 07 41 13 – Metal Roofing and Wall Panels
 - 3. Section 07 46 17 - Metal Soffit and Facia Systems
 - 4. Section 07 62 00 - Sheet Metal Flashing and Trim
 - 5. Section 07 92 00 - Joint Sealants

1.02 REFERENCES

- A. ASTM:
 - 1. D3679 - Rigid Poly Vinyl Chloride (PVC) Siding
 - 2. D4477 - Rigid Unplasticized PVC Soffit
 - 3. D4756 - Installation of PVC Siding and Soffits

1.03 SUBMITTALS

- A. Provide submittals according to Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, maintenance and cleaning recommendations, and research and evaluation reports.
- C. Samples:
 - 1. Submit with Product Data and Shop Drawings, manufacturer's standard color selections, pattern, and texture samples for each type of material, showing a full range of variations expected in these characteristics.
 - 2. Sample Size: 12 inches long by actual width of siding.
 - 3. Include notification to architect if selection is not within bid price range.
 - 4. Components: Submit samples of siding anchors, fasteners, hardware, and other materials and components if requested by architect.
- D. Quality Assurance/Control Submittals:
 - 1. Test Reports: Research/Evaluation reports for each type of siding required.
 - 2. Certificates: Submit for each type of siding, signed by product manufacturer.
- E. Maintenance Manual: Provide to owner, maintenance and warranty data in "Maintenance Manual" at maintenance demonstration at Substantial Completion.

1.04 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Obtain siding and related accessories through 1 source from a single manufacturer.
 - 2. Provide vinyl siding products listed in VSI's list of certified products.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of vinyl siding, with 6 projects of similar size, scope and type of which 3 have been in successful use for 3 years or longer.
 - 2. Contractor: 3 years experience in the installation of vinyl siding.
 - 3. Personnel: For actual installation of siding, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in a dry, well-ventilated, weather-tight place.

1.06 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

- B. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 COORDINATION

- A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.08 WARRANTY

- A. Submit written warranty, executed by manufacturer, agreeing to repair or replace siding that fails in materials or workmanship within specified warranty period.
- B. Failures include, but are not limited to, fading, deformation or deterioration of siding beyond normal weathering, including hail.
- C. Warranty period: Minimum 25 years after Final Completion.

1.09 MAINTENANCE

- A. Extra Materials:
 - 1. Provide for maintenance purposes, quantity equal to 2 percent of each type, of material installed.
 - 2. Furnish from same production run as materials installed.
 - 3. Package and mark to identify building and material type and color.
 - 4. Deliver and store where directed by owner.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - 1. Alside, Inc., Akron, OH www.alside.com
 - 2. CertainTeed Corporation www.certainteed.com
 - 3. Crane Performance Siding, Columbus, Ohio www.vinyl-siding.com
 - 4. Wolverine Technologies, Dearborn, Michigan www.siding.com
 - 5. Manufacturer of comparable products meeting requirements of specifications.

2.02 SIDING

- A. Extruded polyvinyl chloride with integral color.
 - 1. Comply with ASTM D3679.
 - 2. Meet class 1 flame spread per ASTM E84.
 - 3. Thickness: Minimum 0.04-inch-thick.
 - 4. Color: Selected by architect from manufacturer's full range.

- 5. Texture: Smooth.
 - 6. Horizontal Pattern:
 - a. 8-inch exposure in plain, double 4 inch board style.
 - 7. Nailing Hem: Double thickness.
- B. Weather Resistant Barrier:
- 1. Felt or kraft Underlayment as recommended by siding manufacturer.
 - a. Weather resistant barrier shall be vapor permeable with a perm rating greater than 10 perms and less than 15 perms when tested according to ASTM E96.

2.03 ACCESSORY COMPONENTS

- A. Accessory Components: Provide starter strips, trim, inside corners, outside corners, drip caps, etc. of same material and finish as siding; ribbed for strength and rigidity.
- B. Integrally colored vinyl accessories: Comply with ASTM D3679 except for wind load resistance.
- C. Fasteners, Nails and Staples: Manufacturer's standard corrosion resistant type; size and strength to securely and rigidly retain siding and accessory components in place. Use concealed fasteners except where approved by architect.
- D. Flashing: Provide pre-finished metal flashing at window and door heads and where indicated. See Section 07 62 00.
- E. Elastomeric Joint Sealant: See Section 07 92 00.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding. Clean substrates of projections and substances detrimental to application.
- B. Proceed with siding installation only if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Ensure weather resistant barrier has been fully installed and sealed prior to siding installation.
- E. Sequencing: Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

3.02 INSTALLATION

- A. Install siding according to manufacturer's instructions, unless more stringent requirements apply. See ASTM D4756.
- B. Securely fasten in place, properly aligned, leveled, and plumb, in continuous lengths without seams.
- C. Center nails in elongated nailing slots without binding siding to allow for thermal movement.
- D. Overlap joints to shed water away from direction of prevailing wind.
- E. Place sealant or gaskets to arrest weather penetration.
- F. Fabrication of component profile on site not permitted.
- G. Ensure site cuttings or burred edges do not remain on finish surfaces.
- H. Maintain neat appearance.

3.03 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective siding materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to siding manufacturer's written instructions and maintain in a clean condition during construction.

SECTION 07 46 46 - MINERAL-FIBER CEMENT SIDING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide fiber cement siding and accessories including, but not limited to:
 - 1. Trim.
 - 2. Fasteners.
 - 3. Weather Resistant Barrier.
- B. Related Sections:
 - 1. Section 04 20 00 – Unit Masonry Assemblies
 - 2. Section 04 43 00 – Stone Masonry
 - 3. Section 06 10 00 – Rough Carpentry
 - 4. Section 07 92 00 - Joint Sealants

1.02 REFERENCES

- A. ASTM:
 - 1. C1186 - Flat, Non-Asbestos Fiber Cement Sheets
 - 2. E84 - Surface Burning Characteristics of Building Materials
 - 3. E136 - Behavior of Materials in a Vertical Tube Furnace

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance and cleaning recommendations.
- C. Shop Drawings: Submit Shop Drawings showing system fabrication, installation drawings, including plans, elevations, sections, details of components, joint locations and configurations within system and between system and adjoining system.
- D. Samples:
 - 1. Initial Color Selection: Submit manufacturer's standard color samples for each type of finish with Product Data and Shop Drawings.
 - 2. Color Verification: Prior to shipping, submit each type of finish indicated; in sets for each color, texture, and pattern specified, showing a full range of variations expected in these characteristics. Include notification to E/A if selection is not within quoted price range.
- E. Maintenance Manual: Provide to owner, maintenance and warranty data in "Maintenance Manual" at Maintenance Demonstration at Substantial Completion.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide fiber-cement siding units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of fiber-cement siding, with 6 projects of similar size, scope and type of which 3 have been in successful use for 3 years or longer.
 - 2. Contractor: 3 years experience in the installation of fiber-cement siding.
 - 3. Personnel: For actual installation of fiber-cement siding, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of Work.
- C. Regulatory Requirements: Comply with local building codes.

1.05 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with siding installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.
- B. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.06 WARRANTY

- A. Special Warranty: Submit written warranty, executed by manufacturer, agreeing to repair or replace siding that fails in materials or workmanship within specified warranty period. Failures include, but are not limited to, cracking, deformation or deterioration of siding beyond normal weathering, including hail.
- B. Include coverage in warranty for freeze-thaw damage.
- C. Warranty period: 50 years after Final Completion.
- D. Finish Warranty: 15 years.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Standard of Quality: Unless indicated otherwise, design is based on HardiPlank Lap Siding by James Hardie Siding Products, Mission Viejo, CA www.hardie.com
- B. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - 1. Allura of Plycem. www.allurause.com
 - 2. Nichia Fiber Cement, www.nichiha.com
 - 3. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIAL

- A. Fiber-Cement Siding:
 - 1. Non-asbestos fiber-cement siding to comply with ASTM C1186 Grade II, Type A.
 - 2. Noncombustible per ASTM E136.
 - 3. Flame Spread Index: 25 or less per ASTM E84.
 - 4. Insect-proof.
 - 5. Nontoxic.
 - 6. Coated.

7. Thickness: 5/16 inch.
 8. Pattern: Horizontal, 6.25-inch wide by 5-inch exposure.
 9. Finish: Smooth Lap.
- B. Trim Boards
1. Non-asbestos fiber-cement siding to comply with ASTM C1186 Grade II, Type A.
 2. Noncombustible per ASTM E136.
 3. Flame Spread Index: 25 or less per ASTM E84.
 4. Texture: Smooth.
 5. Thickness: 4/4-inch
 6. Width: 3-1/2 inch actual width.
- C. Accessories:
1. Trim: Starter strips, trim, inside corners, outside corners, drip caps, etc. of same material and finish as siding.
 2. Fasteners: Manufacturer's standard corrosion resistant hot-dip galvanized or stainless-steel; size and strength to securely and rigidly retain siding and accessory components in place.
 3. Weather Resistant Barrier: Felt or kraft Underlayment as recommended by siding manufacturer.
 - a. Weather resistant barrier shall be vapor permeable with a perm rating greater than 10 perms and less than 15 perms when tested according to ASTM E96.
 4. Other Materials: Materials not specifically described but required for complete, proper installation of fiber-cement siding, subject to acceptance of architect.

2.03 FINISH

- A. Factory finish with manufacturer's standard acrylic finish.
- B. Color: Monterey Taupe.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing Work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that fiber-cement siding may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection: Protect installed work and materials of other trades.
- B. Install weather resistant barriers to surfaces to receive siding and trim. Install per manufacturers instructions and tape and seal all joints.

3.03 INSTALLATION

- A. Install siding according to manufacturer's instructions. Securely fasten in place, properly aligned, leveled, and plumb.
- B. Install siding with fasteners extending through sheathing and directly into wood stud framing or furring. Fasteners into sheathing alone will not be acceptable.
- C. Fabrication of component profile on Site not permitted.
- D. Use concealed fasteners except where approved by architect. Where exposed fasteners are approved, provide color to match item being fastened.
- E. Install weather resistive barriers and claddings to dry surfaces. Repair any punctures of tears in the barrier prior to installation of siding.
- F. Seal cut edges with a water-based primer or paint.
- G. Install joint sealant at joints in siding, except lap joints of siding. Seal around penetrations and paint exposed ends.
- H. Maintain neat appearance.

3.04 REPAIR/RESTORATION

- A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

3.05 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.
- B. System:
 - 1. Remove temporary covering and other provisions made to minimize soiling of other work.
 - 2. Promptly clean surfaces not to receive fiber-cement siding; repair surfaces stained, marred or otherwise damaged during work.
 - 3. Clean exposed surfaces of fiber-cement siding using materials and methods recommended by manufacturer.
 - 4. When work is completed, remove unused materials, containers, equipment, and debris.

3.06 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer to ensure Work is without damage or deterioration at time of Substantial Completion.

SECTION 07 53 23 - EPDM MEMBRANE ROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide thermoset, elastomeric, vulcanized EPDM membrane roofing system, including:
 - 1. Vapor Barrier.
 - 2. Roofing insulation:
 - a. Polyisocyanurate.
 - 3. Membrane Attachment:
 - a. Fully adhered.
 - 4. Single-ply membrane roofing accessories including, but not limited to:
 - a. Pipe seals.
 - b. Adhesives, tapes, and sealants.
 - c. Flashing.
- B. Related Sections:
 - 1. Section 05 12 00 – Structural Steel
 - 2. Section 05 31 00 – Metal Decking
 - 2. Section 06 10 00 - Rough Carpentry

1.02 REFERENCES

- A. ASTM:
 - 1. C578 - Foamed Plastic Insulations
 - 2. C728 - Perlite Thermal Insulation Board
 - 3. C1177 - Glass Mat Gypsum Substrate
 - 4. D41 - Specification for Asphalt Primer
 - 5. D312 - Specification for Asphalt Used in Roofing
 - 6. D412 - Vulcanized Rubber and Thermoplastic Elastomers
 - 7. D471 - Test for Effect of Liquids on Rubber
 - 8. D624 - Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
 - 9. D750 - Test for Rubber Deterioration
 - 10. D751 - Coated Fabrics
 - 11. D1148 - Ultraviolet Degradation of Rubber

12. D1149 - Rubber Deterioration - Surface Ozone Cracking
13. D1204 - Stretching at Elevated Temperatures
14. D1289 - Faced Rigid Cellular Polyiso Thermal Insulating Board
15. D2137 - Brittleness Point of Plastics and Elastomerics
16. D6134 - Vulcanized Rubber Sheets Used in Waterproofing System
17. E96 - Water Vapor Transmission of Materials

B. UL - Class A Fire Rating.

1.03 DEFINITIONS

A. EPDM: Ethylene, propylene diene monomer

1.04 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Provide installed roofing membrane and base flashings that remain watertight and resist exposure to weather without failure.
2. Provide roofing materials that are compatible with one another under conditions of service and application required, as approved by roofing manufacturer.
3. Low slopped roofs: Design to resist uplift pressure calculated according to ANSI/SPRI ES 1.
4. Meet IBC code requirements adopted by state in which project is located.

1.05 SUBMITTALS

A. Provide submittals according to Division 01.

B. Product Data, including specifications, handling, storage and installation instructions, maintenance recommendations, and copy of the warranty.

C. Shop Drawings showing system fabrication, installation drawings, including roof insulation plans indicating layout, slope and average R value, roof seaming plan, details of components, within system and between system and adjoining system.

D. Samples: Manufacturer's standard components, including water barrier membrane, roof insulation, membrane, membrane flashings, securement devices, membrane walkway pads or rolls, roof pavers, and ballast.

E. Quality Assurance/Control Submittals:

1. Manufacturer's representative's written observation reports.
2. Certificates:
 - a. Membrane manufacturer's current written acceptance of installer to architect in duplicate before starting roofing work.
3. Photographs or videotape of existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reproofing operation.

1.06 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Obtain primary flexible sheet roofing from a single manufacturer.
 - 2. Provide secondary materials as supplied by or recommended by manufacturer of primary materials.
- B. Qualifications:
 - 1. Manufacturer: 10 years experience in the manufacture of single ply elastic membrane roofing.
 - 2. Contractor: 3 years experience in the installation of single ply elastic membrane roofing.
 - 3. Personnel: For actual installation of single ply elastic membrane roofing, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.
- C. Regulatory Requirements: Perform work in strict conformance with applicable provisions of manufacturer's current published specifications, application instructions, recommended details, and standards of practice.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
- B. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.

1.08 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.09 WARRANTY

- A. Manufacturer's Warranty: Provide 20-year, non-prorated manufacturer's total system warranty including repair or replacement, materials and labor at no cost to owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Membrane Roofing System (including Insulation):
 - 1. Standard of Quality: Design is based on products of Carlisle SynTec, Inc., Carlisle, PA www.carlisle-syntec.com
 - 2. Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Firestone Building Products, Carmel, IN www.firestonebpco.com
 - b. GAF www.gaf.com
 - c. Versico, Inc., Akron, OH www.versico.com
 - d. Manufacturer of comparable products meeting requirements of specifications.
- B. Insulation:
 - 1. Acceptable Manufacturers: Subject to compliance with requirements and acceptance by membrane manufacturer, acceptable manufacturers and products are:
 - a. Polyisocyanurate:
 - 1) HP-H by Carlisle SynTec, Inc., Carlisle, PA www.carlisle-syntec.com
 - 2) Energyguard by GAF Materials Corporation, Wayne, NJ www.gaf.com.
 - 3) ISO 95+ by Firestone Building Products, Carmel, IN www.firestonebpco.com
 - 4) Versico-Iso by Versico, Inc., Akron, OH www.versico.com
 - 5) Manufacturer of comparable products meeting requirements of specifications.

2.02 ELASTIC SHEET ROOFING MATERIALS

- A. EPDM Membrane:
 - 1. Meet ASTM D6134.
 - 2. Size:
 - a. Fully adhered:
 - 1) Non-reinforced: 60-mil.
 - 3. Color: Black.
 - 4. Standard.
 - 5. Minimum properties under indicated ASTM tests:
 - a. Breaking strength: 90 lbf (400 N) minimum, D751, Grab Method.
 - b. Elongation, ultimate: 250 percent minimum, D751 Grab Method.
 - c. Tear strength: 10 lbf (45N) minimum, D751 B Tongue Tear Method.
 - d. Brittleness point: -49 degrees F minimum, D2137.
 - e. Resistance to heat aging: D573. Prepare specimens from coating rubber compound, vulcanized in a similar method to reinforced product.

- f. Ozone resistance: D1149 - No cracks after exposure to 100 pphm and ozone in air for 168 hours at 104 degrees F. Wrap specimen around 3-inch mandrel.

2.03 ROOF INSULATION

- A. Provide factory-tapered insulation board, fabricated to slope indicated on Drawings for crickets, and other areas without a structural slope.
- B. Provide insulation boards that comply with requirements and reference standards, selected from manufacturer's standard sizes and thicknesses.
- C. Select insulation type compatible with membrane. See manufacturer's requirements.
- D. Thickness:
 - 1. Maximum layer thickness: 2 inches.
- E. Polyisocyanurate Insulation:
 - 1. Meet ASTM C1289.
 - 2. Maximum 4 foot by 8 foot boards.
 - 3. All packages to have RIC/TIMA label.
 - 4. Type II: Felt or glass fiber mat on both surfaces.
 - 5. Minimum 2 layers.
 - 6. Taper top layers where indicated on Drawings.
- F. Provide preformed crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.04 ROOFING ACCESSORIES

- A. Elastic Sheet Flashing: Pressure Sensitive self-adhered flashing membrane by roof membrane supplier.
- B. Adhesives and Sealants:
 - 1. Splicing cement, lap sealant, bonding adhesive, water cutoff mastic.
 - 2. Sealing compound for temporary sealing of membrane (water cutoffs): Provide product acceptable to membrane manufacturer.
- C. Fasteners:
 - 1. Factory Mutual approved.
 - 2. Membrane attachment:
 - a. Length to penetrate 1-1/2 inch wood deck minimum of 1 inch, but not through bottom of deck.
 - b. Length to penetrate through plywood deck minimum 3/4 inch.
 - 3. Flashing to lumber: Galvanized 1 1/2 inch barbed roofing nails through 1-inch metal discs.
- D. Flashing: Recommended by manufacturer with associated adhesives.

- E. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories as recommended by manufacturer.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Verify:
 - 1. Deck is completely installed.
 - 2. Surface is free of debris, sharp projections, gross irregularities, unnecessary holes.
 - 3. Required openings through deck are cut and finished, and pipes and similar work projecting through deck are in place.
 - 4. Substrates have been inspected and are determined to be in satisfactory condition.
- B. Compatibility: Verify that membranes and flashings are chemically compatible with nailers and blocking.
- C. Surface Preparation: Keep deck surfaces clean, dry, and free of dust, grease, debris, frost, or other conditions which might affect installation of roofing.
- D. Coordinate between various trades to avoid unnecessary rooftop traffic over sections of roof and to prevent damage to membrane.
- E. Proceed when existing and forecasted weather conditions permit Work to be performed according to manufacturers' recommendations and warranty requirements.
- F. Do not proceed until conditions which would result in an unsatisfactory installation are corrected.
 - 1. Discrepancies: Immediately notify architect.
 - 2. Commencing work shall be construed as acceptance of roof deck and adjoining surfaces as acceptable to receive membrane sheet roofing.

3.02 PREPARATION

- A. Coordinate with other trades so other work available and roofing can be built in without delay.
- B. Plan Work to be carried on continuously to completion.
- C. Installation of sheet membrane and accessories shall be in strict accordance with membrane manufacturer's written instructions.

3.03 INSTALLATION OF ROOFING COMPONENTS

A. Insulation

1. General:

- a. Cut, fit neatly against wood blocking and vertical surfaces.
- b. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- c. Fill voids greater than 1/8 inch with foamed-in-place insulation compatible with rigid material.
- d. Install tapered insulation to drain to scuppers and roof drains.
- e. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- f. Stagger insulation boards 50 percent from row to row.
- g. Stagger joints in both directions in adjoining courses; stagger end joints between layers minimum of 24 inches.
- h. Butt each panel tightly to adjoining panels, but do not force.

2. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

- a. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

B. Protection:

1. Keep insulation dry.
2. Protect from damage after installation.
3. Lay no more insulation than can be covered with completed roof membrane on same day.
4. Ballast unfinished or unballasted roof areas with sandbags before leaving overnight or during inclement weather.
5. Protect exposed edges of insulation with water cut offs at end of each day's work.
6. Remove water cut-offs completely before resuming work.

3.04 ELASTIC SHEET INSTALLATION

A. Fully Adhered:

1. Fully adhere the membrane to acceptable substrate.

2. Edges and Seams:

- a. Lap edges in direction of roof slope.
- b. Inspect seams for continuity and water tightness, seal exposed edge of lap with lap sealant.
- c. Splice seams as roofing is laid. Complete seams before end of each day's work.
- d. Do not locate seams in valleys, flat areas, or on ridges.

B. Fastening Strips:

1. Install manufactured-specified termination bars with specified or accepted fasteners.
2. Fasten to deck at roof edges, curbs, openings, vertical surfaces, any change in slope exceeding 2 inches vertical per horizontal foot; top of fasteners flush with termination bar, spaced maximum 12 inches on center starting 1 inch from ends of strip.

3.05 ROOF ACCESSORIES

A. Base Flashing:

1. Install sheet flashings and preformed flashing accessories and adhere to substrates.
2. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
3. Flash penetrations and field-formed inside and outside corners with sheet flashing.
4. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
6. Install flashing at parapets, roof edges, curbs, cants.
7. Extend onto roofing at least 3 inches beyond point where sheet roofing fastened to construction.

3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

3.07 PROTECTION AND CLEANING

A. Site Cleaning:

1. Do not allow accumulation of scraps, debris arising from work of this section.
2. Maintain premises in neat, orderly condition.
3. Immediately upon satisfactory completion of work, remove debris, equipment, excess materials from site.

B. System Cleaning:

1. Prevent misplacing roofing materials and adhesives on adjacent surfaces.
2. Immediately remove traces of such materials.

C. Protect completed roof system from damage.

1. Use plywood walkways, wood planking, other precautions as necessary.
2. Institute appropriate procedures for surveillance and protection of roofing during remainder of construction period.
3. Confine traffic over roof to necessary areas, hold to minimum.
4. Repair damage immediately.

- D. When construction completed and roofing no longer at risk of construction damage, remove temporary protective measures, reinstall ballast to satisfaction of owner and manufacturer of existing roofing.

3.08 DEMONSTRATION

- A. Maintenance Instructions: Manufacturer's representative (not installer) to schedule and attend meeting with owner's representatives to explain:
 - 1. Maintenance and Care Instructions.
 - 2. Recommended Maintenance Program.
 - 3. Warranty Requirements.

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

- A. Provide sheet metal flashing and trim for:
 - 1. Roof drainage systems.
 - 2. Metal counter flashing and base flashing.
 - 3. Exterior wall flashing and expansion joints.
 - 4. Roof flashing and accessories.
 - 5. Sheet metal accessories including, but not limited to:
 - a. Joint sealants for sheet metal flashing.
 - b. Water barrier membrane.
 - c. Fasteners.
- B. Related Sections:
 - 1. Section 04 20 00 - Unit Masonry Assemblies
 - 2. Section 06 10 00 - Rough Carpentry
 - 3. Section 07 41 13 - Metal Roofing and Wall Panels
 - 4. Section 07 53 23 - EPDM Membrane Roofing
 - 5. Section 07 92 00 - Joint Sealants

1.02 REFERENCES

- A. ASTM:
 - 1. A167 - Stainless and Heat Resistant Chromium Nickel Steel Plate, Sheet
 - 2. A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Coated (Galvannealed) by the Hot-Dip Process
 - 3. A853 - Steel Wire, Carbon
 - 4. B32 - Specifications for Solder Metal
 - 5. B101 - Lead Coated Copper Sheet and Strip
 - 6. B209 - Aluminum Sheet and Plate
 - 7. B370 - Copper Sheet and Strip

8. C920 - Elastomeric Joint Sealants
9. D522 - Mandrel Test for Organic Coatings, Formability
10. D1970 - Self-Adhering Polymer Modified Bituminous Sheet Materials
11. D2244 - Color Tolerances
12. D2794 - Impact Resistance
13. D4214 - Evaluation of Degree of Chalking
14. E111 - Modulus Testing, Elasticity
15. E228 - Test for Thermal Expansion
16. G90 - Performing Accelerated Weathering of Non-Metallic Materials

B. SMACNA: Architectural Sheet Metal Manual

1.03 SUBMITTALS

- A. Provide submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings: Include layout, profiles, methods of joining, and anchorage details.
- D. Samples:
 1. Color: Submit manufacturer's standard color samples with Product Data and Shop Drawings.
 2. Samples of sheet metal flashing, trim, and accessory items in specified finish, showing full range of variations expected.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide sheet metal flashing and trim units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
 1. Manufacturer: 5 years experience in the manufacture of sheet metal flashing and trim.
 2. Contractor: 3 years experience in the installation of sheet metal flashing and trim.
 3. Personnel: For actual installation of sheet metal flashing and trim, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.
- C. Regulatory Agencies:
 1. Meet UL requirements for fire resistance of roof covering materials and impact resistance.
 2. Meet wind/uplift resistance of ANSI/SPRI ES 1 per IBC.

1.05 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.06 COORDINATION

- A. Furnish metal base flashings, gravel stops, other work required to be built into roofing and flashing promptly so roofing operations may be carried on continuously to completion without delay.

1.07 WARRANTIES

- A. Manufacturer: Non-prorated 20-year written warranty covering fade, chalking and film integrity including labor and material through the 20th year.
- B. Contractor:
 - 1. Sheet metal system and related flashing shall be warranted in writing stipulating that contractor agrees to maintain metal flashing system in a watertight condition for a period of 5 years at the contractor's own expense.
 - 2. Warranty shall cover any condition caused by defective material and the installation and ordinary wear and tear.
 - 3. Warranty does not cover damage due to natural disaster not covered by insurance, accidents, misuse or vandalism.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Flashing and Trim:
 - 1. Standard of Quality: Design is based on UnaClad, Firestone Metal Products www.unaclad.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Berridge Manufacturing, Houston, TX www.berridge.com
 - b. W.P. Hickman Company, Asheville, NC www.wph.com
 - c. PacClad, Elk Grove Village, IL www.pac-clad.com
 - d. ColorKlad by Ryerson, Minneapolis, MN www.ryerson.com
 - e. Manufacturer of comparable products meeting requirements of specifications.
- B. Manufactured Products:
 - 1. Standard of Quality: Design is based on Metal Era, Inc, Waukesha WI www.metalera.com

2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. W.P. Hickman Company, Asheville, NC www.wph.com
 - b. Manufacturer of comparable products meeting requirements of specifications.
- C. Water Barrier Membrane: Standard of Quality: Design is based on CCW WIP 300HT by Carlisle Coatings and Waterproofing www.carlisle-ccw.com
 1. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Ice and Water Shield, Grace Company www.grace.com
 - b. Winterguard, CertainTeed, Valley Forge, PA www.certainteed.com
 - c. Polyguard Inc., Ennis, TX www.polyguardproducts.com
 - d. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Sheet Metal:
 1. Verify recycled content from manufacturer.
 2. Performance Requirements:
 - a. Color Change: ASTM D2244, Not greater than 5 NBS color units.
 - b. Chalking: 8 or better, ASTM D4214.
 - c. Minimum yield: ASTM A853.
 - d. Formability: ASTM D522.
 - e. M.O.E.: ASTM E111.
 - f. COTE: ASTM E228.
 - g. Impact resistance: ASTM D2794, 70 inch/pound, no tape pick-off.
 3. Galvanized Steel:
 - a. Standard open hearth copper bearing steel with "Paint-Grip" galvanized coating.
 - b. 24 gage minimum. For use as keepers or when otherwise covered.
 - c. Pre-painted sheets of hot-dipped galvanized steel of commercial weight and quality, ASTM A653, G90.
 - d. Painted side shall be covered with a factory applied strippable film.
 - e. Apply washcoat of 0.3 to 0.4 mil dry film thickness to unpainted side.
 - f. Gages: As indicated on Drawings. Where not indicated, minimum gages:
 - g. Facias, coping, and other roof edge flashing exposed view with an exposed vertical face of 8 inch or less: 24 gage.
 - h. Hook strips and keepers: 24 gage.
 - i. All other sheet metal work: 24 gage.

2.03 SHEET METAL ACCESSORIES

- A. Nails and Fasteners:
 - 1. Galvanized nails and cadmium-plated screws and washers in connection with galvanized iron and steel, which will not stain, produce electrolytic reaction or be detrimental to complete installation.
 - 2. Same metal as sheet metal flashing or recommended by sheet metal manufacturer. Avoid noncompatible or dissimilar metals due to risk of galvanic corrosion.
 - 3. Match finish of exposed heads with material being fastened.
- B. Solder: ASTM B32.
 - 1. Copper: Grade Sn50, 50 percent lead, 50 percent tin solder, commercial soldering flux.
 - 2. Lead-coated copper: Grade Sn60, 60 percent in and 40 percent lead.
- C. Joint Sealant: See Section 07 92 00.
- D. Adhesives: Recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- E. Other Materials: Other materials not specifically described but required for complete, proper installation of sheet metal and flashing, subject to acceptance of architect.

2.04 MANUFACTURED PRODUCTS

- A. Reglets:
 - 1. Factory-mitered and welded corners and junctions.
 - 2. Material:
 - a. Stainless steel.
 - 3. Type:
 - a. Surface-mounted type.
 - b. Masonry type.
 - c. Flexible flashing retainer.
 - d. Counterflashing wind-resistant clips.
- B. Flashings and Facia:
 - 1. Preformed Coping:
 - a. 0.063 aluminum.
 - b. Concealed joint covers.
 - c. Metal drain support chairs, same color and finish as coping cap.
 - d. 20 gage galvanized steel cleats.
 - e. 20 year, 110 mph wind warranty.
 - f. FM 1-90 approved for wind uplift.
 - g. Finish: Finish to match standing seam metal roof.

2. Preformed Roof Edge:
 - a. 0.063 aluminum.
 - b. FM 1-90 approved for wind uplift.
 - c. 20 year, 110 mph wind warranty.
 - d. Concealed joint splice plates.
 - e. Finish: Finished to match standing seam metal roof.
 3. Formed Facia Spillout Scupper:
 - a. 0.063 aluminum.
- C. Gutter Screen: 1/4-inch hardware cloth installed in sheet metal frames. Use same material as gutters and downspouts.

2.05 WATER BARRIER MEMBRANE

- A. Cold-applied Self-adhering Membrane:
1. High-strength polyethylene film coated on 1 side with a thick layer of adhesive consistency rubberized asphalt.
 2. Membrane to be able to withstand temperature of 200 degrees F without adhesive degradation.
 3. ASTM D1970.
 4. Thickness: 0.004 inch.
 5. Provide complete with manufacturer's recommended primer.

2.06 FABRICATION

- A. General Requirements:
1. Comply with SMACNA's "Architectural Sheet Metal Manual."
 2. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Fabricate with strippable film in place.
 4. Accurately form with brakes, straight, true, and sharp; plain surfaces free from warps and buckles and tool marks.
 5. Fabricate nonmoving seams with flat-lock seams. Where joint movement is necessary, provide 1-inch-deep interlocking hooked flanges, filled with mastic sealant.
 6. Tin edges to be seamed, form seams, and solder.
 7. Match profiles exactly at connections.
 8. Exposed edges to be beaded or returned for strength and appearance.
 9. Allow for expansion and contraction.
- B. Reinforcement: Provide ribs, cleats, and reinforcement necessary to make sections rigid and substantial.
- C. Seams, Joints:
1. Locate joints of roof edges, other sheet metal work exposed to view with respect to, control joints, other architectural features as indicated on Drawings or as directed by Architect.
 2. Overlap in direction of flow.

3. Use concealed cover plates.
 4. Where appearance is not a factor, fabricate in 8 or 10-foot lengths.
 5. Design field joints to permit expansion.
 6. Use joint covers or lapped joints with "s" clips; do not solder.
 7. Locate field joints at least 12 inches, no more than 3 feet, from actual corner.
 8. Provide 4-inch-wide flanges for setting on built-up asphalt roofing system membrane with concealment by composition stripping.
 9. Fabricate gravel stops and aggregate divider strips with 1 inch high standing leg of folded sheet metal, notched from top with deep "V" notches.
- D. Penetration Sleeves: Fabricate with minimum 8-inch-high stack, of diameter 1 inch larger than penetrating element.
- E. Soldering:
1. Pre-tin edges of sheet metal to be soldered with solder on both sides, width of pre-tinning at least 1 1/2 inches.
 2. Solder slowly with well-heated coppers to thoroughly heat sheets and completely sweat solder through full width of seam. Use ample solder.
 3. Show at least 1 inch evenly flowed solder at seams.
 4. Wherever possible solder work in flat position.
 5. Solder seams with a slope greater than 45 degree a second time.

2.07 FINISHES

- A. Coating System: 2-coat system of organic coating on the face side consisting of fluorocarbon base top coat applied over quality matched primer with white wash coat applied to back side for additional protection.
1. Colors: colors will be selected by architect from standard range of smooth finishes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades:
1. Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
 2. Coordinate Work with interfacing and adjoining Work, for proper sequencing of each installation.
 3. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.
- B. Verification of Conditions: Verify that flashing and sheet metal may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved.

3.02 METAL PROTECTION

- A. Do not place dissimilar metals in contact nor in position where drainage will occur across them.
- B. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
- C. Water Barrier Membrane:
 - 1. Install as recommended by manufacturer at locations indicated on Drawings.
 - 2. Use of primer is required.

3.03 INSTALLATION

- A. General:
 - 1. Apply fabrication instructions of this Section to field installation.
 - 2. Install with strippable film in place.
 - 3. Install work neatly and anchor securely.
 - 4. Overlap seams in direction of flow and slope all horizontal surfaces for drainage.
 - 5. Join parts with rivets or sheet metal screws where necessary for strength or stiffness.
 - 6. Whenever possible, secure metal by means of clips or cleats without nailing through metal, in no case shall nails, rivets, or screws be exposed on outside of facias, copings, etc.
 - 7. Secure metal flashings at roof edges according to ANSI/SPRI ES 1 Loss Prevention Data Sheet 1-49 for wind zone of Project.
 - 8. Equipment support flashing: Coordinate with roofing and equipment installation. Weld or seal flashing to equipment support member.
 - 9. Finished work to be water, weather tight.
- B. Expansion Provisions:
 - 1. Provide for thermal expansion of exposed flashing and trim.
 - 2. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner of intersection.
 - 3. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- C. Joint Sealants: Apply wherever required to ensure watertight installation of sheet metal flashing after removing protective film.
- D. Reglets: 04 20 00 for installation.

3.04 ADJUSTING

- A. Replace or repair sheet metal flashing and trims that have been damaged or deteriorated beyond successful repair by finish touching or similar repair procedures.

3.05 CLEAN UP

- A. Immediately after completing work, remove strippable film.
- B. Clean sheet metal surfaces with mild soap and water to be suitable to receive specified finishes.
- C. Remove substances that might cause corrosion of metal or deterioration of finishes.

3.06 PROTECTION

- A. Provide final protection and maintain conditions to ensure flashing and trim are without damage or deterioration other than natural weathering at the time of Substantial Completion.

SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Firestopping for penetrations through:
 - a. Fire-resistance-rated walls and partitions.
 - 2. Sealant joints in fire-resistance-rated construction.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete
 - 2. Section 04 20 00 - Unit Masonry Assemblies
 - 3. Section 06 10 00 – Rough Carpentry
 - 4. Section 07 21 00 - Thermal Insulation
 - 5. Section 07 92 00 - Joint Sealants
 - 6. Section 08 11 13 - Hollow Metal Doors and Frames
 - 7. Section 09 29 00 - Gypsum Board

1.02 REFERENCES

- A. ASTM:
 - 1. C665 - Mineral Fiber Blanket for Thermal Insulation
 - 2. C719 - Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement
 - 3. C920 - Elastomeric Joint Sealant

4. E84 - Surface Burning Characteristics of Building Materials
5. E119 - Fire Tests of Building Construction and Materials
6. E814 - Fire Tests of Through-Penetration Fire Stops

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Provide firestopping systems to resist the spread of fire according to requirements indicated, and the passage of smoke and other gases.
2. Provide products that upon curing do not re-emulsify, dissolve, leach, breakdown, or other deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.
3. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage to the seal.
4. Firestopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local Building Code and as tested by nationally accepted test agencies per ASTM E814.
5. Rated Systems:
 - a. F-Rated systems: Provide as determined per ASTM E814, must be a minimum of 1 hour but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
 - b. T-Rated systems:
 - 1) T rating, when required by code authority, shall be based on measurement of the temperature rise on the penetrating items. The fire test shall be conducted with a minimum positive pressure differential of 0.01 inch of water column.
 - 2) For the following conditions, provide T ratings, in addition to F ratings, as determined per ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas:
 - a) Penetrations located outside of wall cavities.
 - b) Penetrations located outside fire-resistive shaft enclosures.
 - c) Penetrations located in construction containing doors required to have a temperature-rise rating.
 - d) Penetrating items larger than a 4 inch diameter nominal pipe or 16 square inches in overall cross-sectional area.
 - c. L-Rated systems: Where through-penetration firestop systems are indicated in smoke barriers, provide systems with L ratings of not more than 3.0 cfm/square foot at both ambient temperatures and 400 degrees F.

6. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions both during and after construction.
 - a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - b. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
 - c. Provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E84.
7. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

1.04 SUBMITTALS

- A. Make submittals according to Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance and cleaning recommendations.
- C. Shop Drawings: Submit showing system fabrication, installation drawings, including details of components, joint locations and configurations within system and between system and adjoining system.
 1. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.
 2. Submit schedule of product used for each type of joint.
- D. Samples: Submit samples of materials and components if requested by architect.
- E. Quality Assurance/Control Submittals:
 1. Test Reports: Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping.
 2. Certificates: Product certificates signed by manufacturers, certifying that their products comply with specified requirements.
- F. Maintenance Manual: Provide to owner, maintenance and warranty data in "Maintenance Manual" at Maintenance Demonstration at Substantial Completion.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide firestopping throughout Project from 1 manufacturer to the greatest extent possible.

- B. Qualifications:
1. Manufacturer: 5 years experience in the manufacture of firestopping, with 6 projects of similar size, scope and type of which 3 have been in successful use for 3 years or longer.
 2. Contractor: 3 years experience in the installation of firestopping.
 3. Installer: Use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work, approved by FMG 4991 "Approval of Firestop Contractors."
- C. Certifications: Provide to architect, certification of installer from manufacturer of firestopping.
- D. Regulatory Requirements:
1. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under Performance Requirements:
 - a. Firestopping tests to be performed by a qualified testing and inspecting agency that is acceptable to authorities having jurisdiction.
 - b. Through-penetration firestop systems and fire-resistive joint sealant systems are identical to those tested per ASTM E814 under conditions where positive furnace pressure differential of at least 0.01 inch of water (2.5 Pa) is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
 - 1) Products bear classification marking of qualified testing and inspecting agency.
 - 2) Systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," or by another qualified testing and inspecting agency.
- E. Owner may employ and pay a qualified inspection agency to check installed firestopping systems for compliance with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestop system products to Site in original, unopened containers or packages with intact and legible manufacturers' labels identifying:
1. Product and manufacturer.
 2. Date of manufacture.
 3. Lot number.
 4. Shelf life.
 5. Qualified testing and inspecting agency's classification marking applicable to Project.

6. Curing time.
 7. Mixing instructions for multicomponent materials.
- B. Store and handle materials for firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements:
1. Do not install when:
 - a. Ambient or substrate temperatures are outside limits permitted by manufacturers.
 - b. Substrates are wet due to rain, frost, condensation, or other causes.
 2. Ventilation: Ventilate per manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.
 3. Provide products containing no asbestos, PCBs, lead, or ethylene glycol.
 4. Do not use any product containing solvents or requiring disposal as hazardous waste.
- B. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.08 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core drilled holes, or cut openings to accommodate firestop systems.
- C. Notify owner's inspecting agency at least 7 days in advance of firestop installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up firestop installations that will become concealed behind other construction until each installation has been examined by owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers are:
1. 3M Fire Protection Products Divisions www.3m.com/firestop
 2. Grace Construction Products www.na.graceconstruction.com
 3. Hilti, Inc. www.us.hilti.com

4. Specified Technologies Inc. (STI) www.stifirestop.com
5. Manufacturer of comparable products meeting requirements of specifications.

2.02 COMPONENTS

- A. Compatibility: Provide firestopping and joint sealants composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application.
- B. Fill Materials:
 1. Safing Insulation:
 - a. Fibers bonded and preformed into flexible batts. Asbestos free.
 - b. ASTM C665, Types I and III.
 - c. Facing: Unfaced.
 2. Intumescent Latex Sealant:
 - a. Single-component, intumescent, latex formulation, non sag.
 - b. Product:
 - 1) FlameSafe PSI900, Grace.
 - 2) SpecSeal SSS100, STI.
 - 3) CP 25WB, 3M.
- C. Fire-Resistive Elastomeric Joint Sealants:
 1. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
 2. Sealant Colors: Provide color of exposed joint sealants to comply with the following:
 - a. Provide selections made by architect from manufacturer's full range of standard colors for products of type indicated.
 3. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
 - a. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, and remain in compliance with other requirements of ASTM C920 for uses indicated:
 - 1) 50 percent movement in both extension and compression for a total of 100 percent movement.
 - b. Product:
 - 1) CP6015, Hilti.
 - 2) SpecSeal ES, STI.

- D. Accessories: Provide components that are needed to install fill materials and to comply with Performance Requirements. Use only components specified by the manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
1. Permanent forming/damming/backing materials including the following:
 - a. Slag/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated formboard.
 - d. Joint fillers for joint sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.03 MIXES

- A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect, with installer present, and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that firestopping may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection: Protect installed work, adjacent areas, and materials of other trades.
- B. Surface Preparation:
 1. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

- a. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 - b. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - c. Remove laitance and form release agents from concrete.
2. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.03 INSTALLATION

A. Through-Penetration Firestops:

1. Comply with manufacturer's installation instructions and drawings pertaining to products and applications indicated.
2. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings indicated.
3. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
4. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - a. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - c. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

B. Fire-resistive Joint Sealants:

1. Comply with manufacturer's installation instructions and drawings pertaining to products and applications indicated.
2. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
3. Install fill materials for fire-resistive joint systems by proven techniques to produce following results:
 - a. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 - b. Apply fill materials so they contact and adhere to substrates formed by joints.

- c. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal or plastic labels.
- B. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or Firestop systems.
- C. Use mechanical fasteners for metal labels.
- D. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted.
- E. Include the following information:
 - 1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Through-penetration Firestop system designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Name of manufacturer.
 - 6. Name of installer.

3.05 FIELD-QUALITY CONTROL

- A. Site Tests:
 - 1. Inspecting agency employed and paid by owner may examine completed firestopping to determine if it is being installed in compliance with requirements.
 - 2. Inspecting agency will report observations promptly and in writing to Contractor and architect.
 - 3. Where deficiencies are found, repair or replace firestopping at no cost to the owner, so that it complies with requirements
 - 4. Additional inspecting, at contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 - 5. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

3.06 ADJUSTING

- A. Repair or replace damaged materials with new materials complying with specified requirements.

3.07 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.
- B. System:
 - 1. Remove temporary covering and other provisions made to minimize soiling of other work.
 - 2. Promptly clean surfaces not to receive firestopping; repair surfaces stained, marred or otherwise damaged during work.
 - 3. When work is completed, remove unused materials, containers, equipment, and debris.

3.08 DEMONSTRATION

- A. General Requirements: Provide VHS video tape of demonstrations to owner.
- B. Maintenance Instructions: Manufacturer's representative to schedule and attend meeting with owner's representatives to explain:
 - 1. Maintenance and Care Instructions.
 - 2. Recommended Maintenance Program.
 - 3. Warranty Requirements.

3.09 PROTECTION

- A. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion.
- B. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide sealant and backup materials:
 - 1. Exterior construction joints.
 - 2. Interior joints.
- B. The following joint sealant is not included in this section:
 - 1. Interior and Exterior Concrete Slab Joint Sealant (Section 03 30 00).

- C. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete
 2. Section 03 45 00 – Precast Architectural Concrete
 3. Section 04 20 00 - Unit Masonry Assemblies
 4. Section 04 43 00 – Stone Masonry
 5. Section 07 41 13 – Metal Roofing Panels
 7. Section 07 84 00 - Firestopping
 8. Section 08 43 13 - Aluminum-Framed Storefront
 9. Section 08 90 00 – Louvers and Vents

1.02 REFERENCES

- A. ASTM:
1. C834 - Latex Sealants
 2. C919 - Use of Sealants in Acoustical Applications
 3. C920 - Elastomeric Joint Sealants
 4. C1021 - Laboratories Engaged in Testing Sealants
 5. C1193 - Standard Guide for Use of Sealants
 6. C1521 - Evaluation of Adhesion of Installed Weatherproofing Sealant Joints
 7. E119 - Fire Tests of Building Construction and Materials
 8. E548 - Evaluation and Assessment of Analytical Chemical Laboratories
- B. Sealant, Waterproofing, and Restoration Institute (SWRI)

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Environmental Requirements:
1. Avoid indoor use of sealants that may contribute to indoor air quality problems, including the following:
 - a. Butyl rubber.
 - b. Solvent-based acrylic.
 - c. Neoprene.
 - d. Styrene butadiene rubber.
 - e. Nitrile.
 - f. Methylene chloride or chlorinated hydrocarbons.
 - g. Products containing bactericides and fungicides classified as phenol mercury acetates, phenol phenates, or phenol formaldehyde.
 - h. Provide acrylic latex or silicone sealants with less than 50 g/l VOCs.
 - i. Provide polyurethane products with less than 200 g/l VOCs.

1.04 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data:
 - 1. Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
 - 2. Provide Product Data on manufacturer's adhesion and stain testing.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Color Samples: Submit manufacturer's standard color samples with Product Data and Shop Drawings.
- E. Environmental Submittals:
 - 1. Submit manufacturer's product data for adhesives and sealants, including printed statement of VOC content.
- F. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- H. Field Test Report Log: For each elastomeric sealant application.

1.05 QUALITY ASSURANCE

- A. Provide joint sealants units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of joint sealants.
 - 2. Contractor: 3 years experience in the installation of joint sealants.
 - 3. Personnel: For actual installation of joint sealants, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

- C. Regulatory Requirements:
 - 1. Silicone Sealants: Certified by Sealant, Waterproofing, and Restoration Institute (SWRI).
- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.
 - 3. Notify architect 7 days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - 5. Method below is the first of 4 test methods recommended in Appendix X1.1 in ASTM C1193. Revise if one of the other three test methods is more appropriate for Project joint conditions.
 - a. Test method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193.
 - b. 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.
 - 6. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Below 40 degrees F ambient temperature, refer to manufacturer's recommendations.
 - 2. Ensure joint substrates are dry and frost-free.
 - 3. Remove contaminants from joint substrate capable of interfering with adhesion.

1.07 WARRANTY

- A. Provide manufacturer's 5-year standard material warranty.
- B. Include coverage for replacement of sealant materials which fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Joint Sealants:
 - 1. Standard of Quality: Design is based on products of Sonneborn by BASF, www.basfbuildingsystems.com
 - 2. , unless noted otherwise.
 - 3. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Tremco, Beachwood, OH www.tremcosealants.com,
 - b. Manufacturer of comparable products meeting requirements of specifications.
- B. Backer Rod/Backup Filler Materials:
 - 1. Acceptable Manufacturers; subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Exterior Joints: Non-absorbent; Sof-Rod by Nomaco www.nomaco.com, Backer Rod Manufacturing and Supply
 - b. Interior Joints: Open-cell, Den-verfoam by Backer Rod Manufacturing and Supply www.bayindustries.com/backerrod
 - c. Manufacturer of comparable products meeting requirements of the specifications.

2.02 MATERIALS

- A. Do not use materials stored longer than their maximum recommended shelf life.
- B. Exterior Construction Joint Sealant:
 - 1. Silyl-terminated Polyether Sealant (MS polymer):
 - a. Low-modulus, high-movement, nonsag, fast-curing.
 - b. ASTM C920.
 - c. Type and grade: S (single component) and NS (nonsag).
 - d. Class: 100/50 for vertical joints.
 - e. Product:
 - 1) Masterseal NP 150 by BASF.
- C. Exterior Concealed Joints Under Thresholds: 1-part butyl rubber caulk conforming to FS TT-S-001657, Type 1.
- D. Aluminum, Sheet Metal, Glass, Glazing and Storefront Joint Sealants:
 - 1. Silyl-terminated Polyether Sealant:
 - a. Low-modulus, high-movement, nonsag, fast-curing.
 - b. ASTM C920.
 - c. Type and grade: S (single component) and NS (nonsag).
 - d. Class: 100/50 for vertical joints.
 - e. Product:
 - 1) Masterseal NP 150 by BASF.

- E. Interior Joint Sealants:
 - 1. Interior Dry Areas: Fast setting acrylic latex sealant meeting ASTM C834, Type P, Grade NF.
 - a. Product: Tremflex 834, by Tremco.
 - b. Maximum VOC content: 42 grams per liter.
 - 2. Interior Wet Areas: 1-part mildew-resistant silicone rubber conforming to ASTM C920, Type S, Grade NS.
 - a. Product: Tremsil 200 by Tremco.
- F. Backup Filler Materials: Non-oily, non-staining, non-gassing, back-up filler or other filler completely compatible with sealant, approved by sealant manufacturer.
- G. Other Materials: Other materials not specifically described but required for complete, proper installation of joint sealants, subject to acceptance of architect.
- H. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction and field tests.
- I. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

2.03 EQUIPMENT

- A. Must be specifically recommended for use by manufacturer of sealant being installed.

2.04 FINISHES

- A. Exterior: Selected by architect from manufacturer's standard colors.
- B. Interior: Match paint color or adjoining substrate color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that joint sealants may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Surfaces to be Caulked: Verify that surfaces are sound, thoroughly dry, clean, free of oil, grease, laitance, rust, and other foreign material that would prevent proper adhesion, and that concrete and mortar are thoroughly cured.
- B. Masonry Cleaning: Complete before surface preparation is begun.
 - 1. Prepare joints and surfaces to receive sealants according to sealant manufacturer instructions.
 - 2. Rake and clean out joints to full depth and width.
 - 3. Clean concrete, masonry, other porous materials by brushing, grinding, other mechanical means, to provide sound, clean surface.
 - 4. Remove dust, dirt, loose particles resulting from mechanical cleaning by vacuuming or blowing out joints with compressed air.
- C. Clean glass, metal, and non-porous surfaces.
- D. Remove protective coatings on metal using solvent that leaves no residue.
 - 1. Use clean white cloths or lintless paper towels to apply solvent, and wipe surfaces dry with dry cloths or paper towels.
 - 2. Do not allow solvent to air dry without wiping.
- E. Mask joints as necessary to protect adjacent surfaces.
 - 1. Apply masking tape in continuous strips and carefully align with edge of joint.
 - 2. Remove masking immediately after joints have been sealed and tooled.

3.03 BACK-UP MATERIALS

- A. Verify compatibility of filler material with sealant before installation.
- B. Install appropriate size backer rod directly into the control joint, larger than joint per manufacturer's recommendations, and in manner to provide concave sealant profile.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Where joint depth does not permit installation of backer rod, install adhesive-backed polyethylene bond-breaker tape along entire back of joint to prevent 3-sided adhesion of joint sealant.
- E. Use filler about 1/3 to 1/2 wider than width of joint so filler exerts sufficient pressure to provide substantial resistance to displacement.

3.04 SEALANT PRIMER

- A. Prime all joints. Do not allow primer to get outside of joints.
- B. Apply as recommended by manufacturer of sealant.
- C. Prime and seal on same workday.

3.05 APPLICATION OF SEALANT

- A. Apply strictly according to manufacturer's instructions, using nozzle of sufficient size to fill joint completely.
- B. Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 - 4. Install joint sealant to all joints except those that allow moisture to drain.
 - 5. Caulk wide joints with three passes.
 - 6. Run a bead at each inside corner, fill joint with third pass.
- E. Tool joints immediately after application of material to ensure full contact with adjacent surfaces.
- F. Strike off excess material. Finished bead is to be flush with adjoining surfaces, unless otherwise indicated on Drawings.

3.06 CURING

- A. Allow minimum 7 days for full cure.
- B. Do adhesion testing after 7 days.
- C. Painting Sealant:
 - 1. Allow 7 days to cure before applying paint.
 - 2. Match sealant to paint colors.

3.07 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for the first 1,000 feet of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform 1 test for each 1,000 feet of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab or Method B, Exposed Surface Finish Hand Pull Tab or Method C, Field-Applied Sealant Joint Hand Pull Flap or Method D, Water Immersion in Appendix X1 in ASTM C1193, as appropriate for type of joint-sealant application indicated.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
 4. Inspect tested joints and report on the following:
 - a. 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 type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
 5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 6. 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.

3.08 ADJUSTING

- A. Non-compliant Work: Allow inspections of Work and assist in testing requested by manufacturer's representative and architect. Remove adjacent Work until location is reached where installation was performed properly.
- B. Remove and replace uncured sealant.

3.9 CLEAN UP

- A. Remove masking, excess material, smears as work progresses.
- B. Leave adjacent surfaces clean and free of sealant and primer.

3.10 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion.
- B. If damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

DIVISION 8 - OPENINGS

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES (COMMERCIAL)

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Steel swing doors:
 - 2. Steel frames:
 - 3. Interior steel framed lites.
 - 4. Steel door and frame accessories including, but not limited to:
 - a. Glazing beads.
 - b. Door silencers.
- B. Furnish the following for other sections to install including, but not limited to:
 - 1. Masonry anchors.
- C. Perform the following:
 - 1. Prepare the door for hardware.
- D. Related Sections:
 - 1. Section 04 20 00 - Unit Masonry Assemblies
 - 2. Section 04 43 00 - Exterior Stone Cladding
 - 3. Section 06 10 00 - Rough Carpentry
 - 4. Section 08 71 00 - Door Hardware
 - 5. Section 08 80 00 - Glazing
 - 6. Section 09 29 00 - Gypsum Board
 - 7. Section 09 91 00 - Painting

1.02 REFERENCES

- A. ASTM:
 - 1. A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware
 - 2. A653 - Steel Sheet Galvanized or Galvannealed by the Hot Dip Process
 - 3. A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy
 - 4. A1011 - Steel, Sheet and Strip, Hot Rolled Carbon, Structural, High-Strength
 - 5. E136 - Combustion Properties of Materials
 - 6. E2074 - Fire Tests of Door Assemblies
- B. Door and Hardware Institute (DHI): Recommended Locations for Builder's Hardware
- C. NFPA 80 - Standard for Fire Doors and Windows
- D. SDI (Steel Door Institute):
 - 1. 100 - Standard Steel Doors and Frames
 - 2. 105 - Erection Instructions for Steel Frames

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Schedule of steel doors and frames using same reference numbers for details and openings as those on Drawings.
- D. Shop Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details.
 - 3. Frame details for each frame type, including dimensioned profiles.
 - 4. Details of locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.
 - 7. Details of glazing frames and stops showing glazing.
 - 8. Details of conduit and preparations for electrified door hardware and controls.
- E. Coordination Drawings: Drawings of each opening, including door and frame, drawn to scale and coordinating door hardware. Show elevations of each door design type, showing dimensions, locations of door hardware, and preparations for power, signal, and control systems.
- F. Samples for Initial Selection: For units with factory-applied color finishes.

- G. Oversize Construction Certification: For steel door assemblies required to be fire rated and exceeding limitations of labeled assemblies, include statement that doors comply with requirements of design, materials, and construction but have not been subjected to fire test.
- H. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of steel door and frame.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide steel door and frame units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of steel door and frame.
 - 2. Contractor: 3 years experience in the installation of steel door and frame.
 - 3. Personnel: For actual installation of steel door and frame, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.
- C. Regulatory Requirements:
 - 1. Steel Door Institute: Comply with standards of ANSI/SDI-100.
 - 2. Fire-rated Door Assemblies: NFPA 80; tested, listed, labeled according to ASTM E2074 by nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle doors and frames according to manufacturer's recommendations.

1.06 PROJECT CONDITIONS

- A. Drawings do not purport to show actual dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 COORDINATION

- A. Coordinate installation of anchorages for steel frames.
- B. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver to Site in time for installation.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Hollow Metal Doors:
 - 1. Standard of Quality: Design is based on products of Steelcraft, Cincinnati, OH www.steelcraft.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Amweld Building Products, Garrettsville, OH www.amweld.com
 - b. Ceco Door, Milan, TN www.cecodoor.com
 - c. Curries, Mason City, IA www.curries.com
 - d. Member of SDI; manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Hot-rolled Steel Sheets: Commercial steel (CS), pickled and oiled; comply with ASTM A1011, type B. Free of scale, pitting, or surface defects.
- B. Cold-rolled Steel Sheets: Commercial steel (CS); comply with ASTM A1008, type B.
- C. Galvanized Steel Sheets: Zinc-coated carbon, commercial steel (CS) type B; ASTM A653, with minimum A40 zinc-iron-alloy (galvannealed) coating designation.
- D. Supports, Anchors: Fabricate of not less than 18-gage galvanized sheet steel. Galvanize units to be built into exterior walls according to ASTM A153, Class B.
- E. Inserts, Bolts, Fasteners: Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, comply with ASTM A153.
- F. Shop Applied Primer Paint: Rust-inhibitive enamel or paint, air-drying or baking, suitable as base for specified finish paints.
- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur compounds, and other deleterious impurities.

2.03 FABRICATION

- A. Steel Door and Frame Units: Rigid, neat in appearance, free from defects, warp or buckle. Where practicable, fit and assemble in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment to assure proper assembly at the Site.
- B. Cold-rolled Steel: Exposed faces of doors and panels, including stiles, rails of nonflush units.

- C. Cold-rolled or hot-rolled steel at fabricator's option: Frames, concealed stiffeners, reinforcement, edge channels, louvers, moldings.
- D. Exposed Fasteners: Countersunk flat phillips heads unless otherwise indicated.
- E. Finish Hardware Preparation:
 - 1. Factory prepare steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00.
 - 2. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
 - 3. Comply with Door Hardware Institute specifications and ANSI A250 for door and frame preparation and location for hardware
- F. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
- G. Galvanizing: Exterior doors and frames
- H. Weep Holes: Provide in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- I. Shop Painting:
 - 1. Clean, treat, paint exposed surfaces of units, including galvanized surfaces.
 - 2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, other foreign materials.
 - 3. Correct minor irregularities with metallic putty sanded smooth before application of paint.
 - 4. Apply shop coat prime paint of even consistency to provide uniformly finished surface ready to receive finish paint.

2.04 STANDARD STEEL DOORS

- A. Flush Swing Door Construction:
 - 1. Exterior Doors:
 - a. Face sheets fabricated from metallic-coated steel sheet.
 - b. Level: SDI Grade III (extra heavy duty).
 - c. Model: L-Series by Steelcraft
 - 1) 16 gage Steel
 - 2) Face: Full flush face, including top of door.
 - d. Core: Polyurethane core.
 - 2. Interior Doors:
 - a. Face sheets fabricated from cold-rolled steel sheet.
 - b. Level: SDI Grade II (heavy duty unless noted otherwise).
 - c. Model: L-Series by Steelcraft
 - 1) 18 gage steel.
 - 2) Face: Full flush face, including top of door.
 - d. Core: Kraft honeycomb.

- B. End Closures:
 - 1. Close off top and bottom of doors with 14-gage (minimum) end closure channels, flush top, inverted bottom.
 - 2. Provide sealant at top of exterior doors for water-tight condition.
- C. Edges: Bevel edges on both sides.
- D. Swing Door Hardware - SDI recommended hardware reinforcing gages:
 - 1. Hinge Reinforcements: 10-gage: 1 1/2 inches by 9 inches.
 - 2. Lock Front and Flush Bolt Reinforcement: 14-gage, 1/2 inch by 3 inches.
 - 3. Cylindrical Lock Reinforcement Units: 14 gage.
 - 4. Mortised Hardware: 14 gage, preparation according to ANSI A250 where applicable. Reinforce, drill and tap to receive hardware.
 - 5. Closer Reinforcement: 14 gage channel, 14 inches long, or to suit closer length, install on all doors.
 - 6. Other Hardware: Refer to SDI recommendations (minimum).
 - 7. Through Bolting: Not allowed.
- E. Accessories:
 - 1. Glazing Beads: Removable glazing bead on interior side of glass only; exterior glazing stop shall be non-removable; Provide muntins if indicated on Drawings.
 - 2. Steel Astragals on Fire Doors: The use of astragals shall comply with the requirements of applicable building codes and NFPA 80.
 - 3. Exit Devices: Pairs of doors to receive exit devices shall be prepared to receive concealed rods.
- F. Label Requirements: Meet all requirements, as set forth by Underwriters Laboratories, Inc., for all label classifications. UL Laboratories, Inc. or Warnock Hersey requirements shall take precedence in all cases.

2.05 STANDARD STEEL FRAMES

- A. General Requirements:
 - 1. Verify quantities and suitability of fasteners.
 - 2. Conceal fastenings, unless otherwise indicated.
 - 3. Exterior Frames: Metallic-coated steel sheet with mitered corners.
 - 4. Interior Frames: Cold-rolled steel (uncoated) sheet with mitered corners.
 - 5. Continuous welded and backwelded corners (through stops).
 - 6. Thickness: 16 gage-thick steel sheet.
 - a. Model: F-Series by Steelcraft
 - 7. Reinforce for hardware using the SDI Hardware Reinforcing Gages as a minimum standard.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames, 2 silencers on heads of double-swing frames.
- C. Glazing Beads: On frame assemblies indicated to have glazed openings, the frame shall be provided with glazing beads designed to receive the glass and gaskets.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect, with Installer present, and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that steel doors and frames may be installed according to original design, installation tolerances, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies:
 - 1. Immediately notify architect.
 - 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 3. Commencement of installation signifies acceptance of surface conditions

3.02 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.03 INSTALLATION

- A. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Frames:
 - 1. Comply with SDI-105:
 - 2. Except for frames located at in-place concrete or masonry and at drywall installations, place prior to construction at enclosing walls and ceilings.
 - 3. Set accurately in position, plumbed, aligned, braced securely until permanent anchors set.
 - 4. Remove temporary braces and spreaders after wall construction is completed, leaving surfaces smooth and undamaged.

5. Install frames with removable glazing stops located on secure side of opening.
 6. Install door silencers in frames before grouting.
 7. Install fire-rated frames according to NFPA 80.
- C. Anchors:
1. Floor anchors: Provide for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors. Powder-actuated fasteners may be used if indicated and approved on Shop Drawings.
 2. Masonry construction: Locate 3 wall anchors per jamb at hinge and strike levels.
 3. In-place concrete or masonry construction: Set, secure to adjacent construction with machine screws and masonry anchorage devices.
 4. Stud partitions: Install minimum 3 wall anchors per jamb at hinge and strike levels.
 5. Open steel stud partitions: Place studs in wall anchor notches, wire tie.
 6. Closed steel stud partitions: Attach wall anchors to studs with tapping screws.
 7. Where frames require existing opening anchors, “dimple” to receive countersunk flathead expansion anchor screws, setting screw heads below surface of frame. Fill countersink with metal putty, grind smooth to match adjacent surface. Prime affected area to match shop finish.
 8. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing anti-freezing agents.
- D. Door Installation:
1. Fit accurately in frames within clearances specified in SDI-100.
 2. Shim as necessary.
 3. Place fire-rated doors with clearances specified in NFPA 80.

3.04 ADJUSTING, CLEANING

- A. Remove and replace defective work, including steel doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Clean grout and other bonding material off doors and frames immediately after installation.
- C. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat; apply touch-up of compatible air-drying primer.
- D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer’s written instructions.
- E. Final Adjustments: Check, readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

3.05 SCHEDULE

- A. Coordinate Schedule with Drawings and notify architect of any door not scheduled.

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Attic access door.
- B. Related Sections:
 - 1. Section 06 10 00 – Rough Carpentry
 - 2. Section 06 53 17 – Shop-Fabricated Wood Trusses
 - 3. Section 09 29 00 - Gypsum Board

1.02 SUBMITTALS

- A. Product Data: Manufacturer's technical data and installation of customized access doors and frames, including details of frame type, elevations of door design types, anchorage, accessory items. Include type, general location, size, floor construction details, finishes, latching or locking provisions, other data pertinent to installation.
- B. Shop Drawing: Submit for fabrication and installation of access door and frame, including details of frame type, door design type, anchorage, and accessory items.

1.03 QUALITY ASSURANCE

- A. Size Variations: Obtain architect's acceptance of manufacturer's standard size units that may vary slightly from sizes indicated.
- B. Coordination: Furnish inserts and anchoring devices that must be built into other work for installation of access doors. Coordinate delivery with other work to avoid delay.

1.04 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Standard of Quality: Unless indicated otherwise, design is based on products of J.L. Industries, Bloomington, MN www.jlindustries.com
- B. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - 1. Bilco, West Haven, CT www.bilco.com
 - 2. Milcor, Lima, OH www.milcorinc.com
 - 3. Nystrom Building Products, Minneapolis, MN www.nystrom.com
 - 4. Manufacturer of comparable products meeting requirements of specifications.

2.02 COMPONENTS

- A. Attic Access Door:
 - 1. Model and Finish: FD; 16 gage steel frame; 16 gage steel door; gray baked enamel prime coat finish.
 - 2. Insulated and gasketed.
 - 3. Size: 22 inches by 30 inches.
 - 4. Hinge: Continuous hinge mounted on long edge of oblong panel unless noted otherwise.
 - 5. Lock: Recessed turn ring. Include interior latch release device for unlatching door from inside attic.
 - 6. Automatic Closing: Spring closer on all size panels to assure positive latching to meet applicable codes.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's instructions for installation.
- B. Coordinate installation with work of other trades.
- C. Set frames accurately in position; securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

3.02 ADJUST AND CLEAN

- A. Adjust hardware and panels after installation for proper operation. Remove and replace panels or frames that are warped, bowed or otherwise damaged.

SECTION 08 33 00 - COILING DOORS AND GRILLES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Overhead coiling grille assembly:
 - a. Curtain.
 - b. Curtain guide jambs.
 - c. Hood.
 - 2. Coiling grille accessories including, but not limited to:
 - a. Removable awning-type hand crank.
- B. Furnish the following for other sections to install:
 - 1. Inserts and anchorages.
- C. Related Sections:
 - 1. Section 04 20 00 - Unit Masonry Assemblies
 - 2. Section 06 10 00 - Rough Carpentry
 - 3. Section 06 40 23 - Interior Architectural Woodwork
 - 4. Section 08 71 00 - Door Hardware
 - 5. Section 09 65 19 – Acoustical Panel Ceilings

1.02 REFERENCES

- A. AAMA 611 - Test procedures and requirements for high performance (Class I) and commercial (Class II) architectural-quality aluminum oxide coatings for aluminum extrusions and panels
- B. ASTM:
 - 1. A653 - Steel Sheet Galvanized or Galvannealed by the Hot Dip Process
 - 2. A666 - Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - 3. B221 - Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.03 SUBMITTALS

- A. Provide submittals according to Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage, and installation instructions, and maintenance recommendations.
- C. Shop Drawings:
 - 1. Submit manufacturer's Shop Drawings showing system fabrication, installation drawings, including plans, elevations, sections details of components, configurations within system and between system and adjoining system.

2. Inserts and Anchorages: For devices which must be set in concrete or built into masonry for installation of units, provide setting drawings, templates, instructions directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
3. Fire Release System: Include complete description of fire release system including electrical rough-in instructions where appropriate.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide coiling doors and grille units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
 1. Manufacturer: 5 years experience in the manufacture of coiling doors and grilles.
 2. Contractor: 4 years experience in the installation of coiling doors and grilles.
 3. Personnel: For actual installation of coiling doors and grilles, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

1.05 PROJECT CONDITIONS

- A. Existing Conditions: Drawings do not purport to show actual dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.06 WARRANTY

- A. Provide manufacturers standard written 2-year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Design is based on model ESG10 as manufactured by Cornell Iron Works, Mountaintop, PA www.cornelliron.com.
- B. Subject to compliance with requirements, acceptable alternate manufacturers and products are:
 1. The Cookson Company, Phoenix, AZ www.cooksondoor.com
 2. Overhead Door Corporation, Lewisville, TX www.overheaddoor.com
 3. Raynor Garage Doors, Dixon, IL www.raynor.com
 4. Manufacturer of comparable products meeting requirements of specifications.

2.02 COMPONENTS

A. Overhead Coiling Grille:

1. Curtain:
 - a. Fabricate grille curtain of a network of 5/16 inch (minimum) diameter horizontal rods spaced approximately 2 inches on center.
 - b. Interconnect rods by vertical links approximately 5/8 inch wide, spaced approximately 9 inches apart and rotating on the rods.
2. Bottom Bar: Manufacturer's standard extruded shape or two angles; materials to match grille.
3. End Locks: Continuous end links or other devices at ends of rods, locking and retaining grille curtain in guides against excessive pressures, maintaining curtain alignment and preventing lateral movement.

B. Door Curtain Guide Jambs:

1. Manufacturer's standard extruded-aluminum shape having curtain groove with return lips or bars to retain curtain.
2. Provide polypropylene pile runners on both sides of curtain to prevent metal to metal contact.
3. Provide mounting angles as required for face of wall mounting.
4. Slot bolt holes for track adjustment.
5. Secure continuous wall angle to wall framing by 3 per inch (minimum) bolts at 30 inches (maximum) on center, unless manufacturer recommends closer spacing.
6. Extend wall angles above door opening head to support coil brackets, unless otherwise indicated.
7. Place anchor bolts on wall guides so that they are concealed from lobby when door is in closed position.
8. Provide removable stops on guides to prevent over-travel of curtain.

C. Counterbalancing Mechanism:

1. Adjustable helical torsion spring counterbalance, with grease-sealed bearings or self-lubricating graphite bearings for rotating members.
2. Barrel: Hot formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of grille without distortion of curtain and limit barrel deflection to not more than 0.03 inch per foot of span under full load; one or more oil tempered torsion springs capable of counter balancing weight of unit.
3. Brackets: Provide manufacturer's standard mounting brackets of cast iron or cold-rolled steel plate with guide groove for curtain.
4. Hood:
 - a. Form to entirely enclose coiled curtain and operating mechanism at opening head, and act as weather seal where required.
 - b. Roll and reinforce top and bottom edges for stiffness.

- c. Provide closed ends for surface mounted hoods and any portion of between-jamb mounting beyond wall face.
- d. Provide intermediate support brackets as required to prevent sag.
- e. Material: Minimum 0.040-inch aluminum hoods for aluminum curtains.

D. Accessories:

- 1. Hand Crank: Provide removable hand crank to allow use by wheelchair bound person.
- 2. Lock: Provide lock to accept keyed cylinder provided by Section 08 71 00.

2.03 OPERATION

- A. Manual Crank Hoist Operation: Doors wider than 12 feet or more than 80 square feet: Provide removable hand crank to eliminate need for crank box at counter level.

2.04 FINISH

- A. Aluminum: Standard mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that coiling doors and grilles may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection: Protect installed work and materials of other trades.

3.03 INSTALLATION

- A. Door and Operating Equipment: Install complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, equipment supports according to final Shop Drawings, manufacturer's instructions, and as specified.

3.04 REPAIR/RESTORATION

- A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

3.05 ADJUSTING

- A. Doors: Upon completion of installation, including work by other trades, lubricate, test, adjust doors to operate in proper manner and easily without binding, free from warp, twist or distortion, fitting properly for entire perimeter.

3.06 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.
- B. System: Clean exposed surfaces of coiling doors and grilles using materials and methods recommended by manufacturer.

3.07 DEMONSTRATION

- A. Startup Services: Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train owner's representative:
 - 1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
 - 2. Train owner's representative on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventative maintenance.
 - 3. Review data in the "Operating and Maintenance Manual."
- B. Maintenance Instructions: Manufacturer's representative to schedule and attend meeting with owner's representatives to explain:
 - 1. Maintenance and Care Instructions.
 - 2. Recommended Maintenance Program.
 - 3. Warranty Requirements.

SECTION 08 36 13 - SECTIONAL STEEL OVERHEAD DOORS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide overhead door system, including:
 - 1. Industrial grade steel sections.
 - 2. Track assemblies:
 - a. Standard Lift.
 - 3. Counterbalancing mechanism.
 - 4. Photo-Eye Safety Device.
 - 5. Operation:
 - a. Electric.
 - b. Controls:
 - 1) Interior 3-button.
 - 2) Radio.

- 6. Sectional overhead door accessories including, but not limited to:
 - a. Weather seals.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry
 - 2. Section 07 46 43 – Plastic Siding
 - 3. Section 08 71 00 - Door Hardware

1.02 REFERENCES

- A. ASTM:
 - 1. A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process
 - 2. A924 - Requirements for Steel Sheet, Metallic Coated, by the Hot Dip Process

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. The U-Value of the installed door shall be 0.15 or less.
 - 2. Wind Loading: Design, reinforce to withstand 20 pounds per square foot wind loading pressure.

1.04 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Manufacturer's current Product Data, including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings, including configurations between system and adjoining system.
 - 1. Complete list of all materials, including bearings and bracings.
- D. Inserts, anchorages to be set in concrete or built into masonry for installation of units, with setting drawings, templates, and directions for installation. See concrete and masonry sections for installation.
- E. Samples:
 - 1. Initial Selection: Submit manufacturer's standard color samples for each type of finish with Product Data and Shop Drawings.
 - 2. Verification: Prior to shipping, submit each type of finish indicated; in sets for each color, texture, and pattern specified, showing a full range of variations expected in these characteristics. Include notification to architect if selection is not within specified price range.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide sectional overhead door units made of components of standard construction furnished by 1 manufacturer as coordinated assembly.
- B. Certifications:
 - 1. Manufacturer: 5 years experience in the manufacture of sectional overhead doors.
 - 2. Contractor: 3 years experience in the installation of sectional overhead doors.
 - 3. Personnel: For actual installation of sectional overhead doors, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.
- C. Regulatory Requirements: Meet OSHA requirement for state in which project is located.

1.06 PROJECT CONDITIONS

- A. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 WARRANTY

- A. Door materials, workmanship, and operation shall be guaranteed for a period of 1 year from Substantial Completion. The contractor shall pay for service trips.
- B. Provide manufacturers standard 10-year warranty against delamination and finish deterioration.

1.08 MAINTENANCE

- A. Maintenance Service: Service on a regular basis (minimum 2) for a period of 1 year.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Industrial Grade:
 - 1. Exterior and Interior Doors: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. 3-Inch Energy Saver Door by Midland Garage Door Mfg. Co. of Chaska, MN www.midlandgaragedoor.com
 - b. Model 3722 by Clopay Doors, Cincinnati, OH www.clopaydoor.com
 - c. Themocore Door, Model 592 by Overhead Door Company, Dallas TX www.overheaddoor.com

- d. Thermospan 200-20 by Wayne-Dalton Corp., Mt. Hope, OH
www.wayne-dalton.com
 - e. Manufacturer of comparable products meeting requirements of specifications.
2. Electric Door Operator: Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
- a. LiftMaster T-Model draw bar type by Chamberlain Group, Inc., Elmhurst, IL www.liftmaster.com, Overhead Door Company, Inc.
 - b. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

A. Industrial Grade:

- 1. Exterior Doors:
 - a. Steel sections:
 - 1) Construct faces of hot-dipped, galvanized, structural quality carbon steel sheets complying with ASTM A653 and A924.
 - 2) Steel sheet thickness
 - a) Exterior Skin: 26-gage minimum.
 - b) Interior Skin: 27-gage minimum.
 - b. Insulation:
 - 1) Insulate inner core of steel sections with high-density polyurethane foam-type insulation.
 - 2) Seal ends and exposed insulation to protect from moisture.
 - 3) Enclose insulation with manufacturer's standard steel sheet secured to door panel.
 - 4) Minimum R-value: 17 at door panel.

2.03 FABRICATION

A. Industrial Grade:

- 1. Fabricate to provide units not more than 24 inches high, nominal 2 inches (minimum) deep.
- 2. Roll horizontal meeting edges to continuous shiplap, rabbeted, or keyed weather seal, with reinforcing flange return.
- 3. Enclose open section with 16-gage galvanized steel channel end stiles welded in place.
 - a. Provide intermediate stiles, cut to door section profile, spaced at not more than 48 inches on center, welded in place.
- 4. Reinforce bottom section with continuous channel or angle conforming to bottom section profile.
- 5. Reinforce sections with continuous horizontal and diagonal reinforcing, as required by door width and design wind loading.
- 6. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth, bolted or welded in place.
- 7. Reinforce sections with backup plates and prepunch for attachment of hardware.

- B. Exterior Doors:
 - 1. Provide a non-conductive thermal break between outside and inside steel faces.
 - 2. Factory install joint seals between sections, perimeter seals at ends of sections, top header seal, and astragal on bottom section.

2.04 COMPONENTS

- A. Industrial Grade:
 - 1. Exterior:
 - a. Track assemblies:
 - 1) Furnish inclined wedge-type track assembly for 2-inch galvanized track and standard-lift operations as indicated, with galvanized steel mounting angles.
 - 2) Support and brace horizontal track at 2 places on each side (double back hung), and cross brace.
 - b. Hardware:
 - 1) General requirements:
 - a) Heavy-duty, rust-resistant.
 - b) Galvanized or cadmium-plated or stainless steel fasteners to suit type of door.
 - 2) Hinges and rollers:
 - a) Provide heavy duty commercial galvanized steel hinges and heavy duty double end hinge with long stem rollers.
 - b) 2-inch rollers shall have continuous steel rims with case-hardened raceways and ball bearings.
 - c. Door springs:
 - 1) Heavy-duty 100,000 cycle.
 - 2) Oil tempered, helical wound torsion type on a solid steel shaft complete with greasible pillow block bearing assemblies.
 - 3) Torsion spring assembly shall be installed to allow for future replacement of components. Install springs with accessories to prevent sagging.
- B. Counterbalancing Mechanism:
 - 1. Torsion Spring: Hang by torsion spring counterbalance mechanism, consisting of adjustable tension tempered steel torsion springs mounted on case-hardened steel shaft, connected to door with galvanized aircraft type lift cable.
 - 2. Cable Drums:
 - a. Cast aluminum or gray iron, grooved to receive cable.
 - b. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft with one additional mid-point bracket for shafts up to 16 feet long, 2 additional brackets at 1/3 points to support shafts over 16 feet long, unless closer spacing recommended by door manufacturer.

- C. Industrial Grade Operation:
1. Operation shall be standard-lift as indicated.
 2. Electric Door Operators: Equip with the following:
 - a. Adjustable disc friction-type clutch, instant reversing contactor, starter, manual reset overload protection, limit switch and heavy duty solenoid actuated brake.
 - b. Quick disconnect for emergency operation. Extend quick disconnect through a minimum of two eyelets down to approximately 6 feet above finish floor using 5/32 inch diameter cable with 6 inch loop at bottom end.
 - c. Control circuit, 24 volt. Control station shall be 3-button momentary contact open/stop/ hold close, fully guarded.
 - d. Draw bar type:
 - 1) Industrial duty draw bar operator; 120 volt, 1 phase, 1/2 HP minimum, UL-Listed or approved equivalent.
- D. Safety Protection:
1. Industrial Grade:
 - a. Furnish and install the following safety protection on all overhead doors unless noted otherwise:
 - 1) Photo eye (emitter-receiver type): 115 volt AC power, UL Listed or approved equivalent.
- E. Control Units:
1. Industrial Grade: Equip each door with 1 radio receiver and 2 radio transmitters.
- F. Accessories:
1. Weather Seals (interior and exterior doors):
 - a. Continuous, rubber, neoprene, or flexible vinyl adjustable weatherstrip gasket at top.
 - b. Tube seals between panel sections.
 - c. Compressible astragal on bottom.
 - d. Continuous flexible seals at door jamb edges for fully weather-tight installation.
 2. Other materials not specifically described but required for complete, proper installation of sectional overhead doors, subject to acceptance of architect.

2.05 FINISHES

- A. Industrial Grade:
1. Exterior Overhead Doors:
 - a. Pretreat zinc-coated steel with zinc phosphate conversion coating after cleaning.
 - b. Apply 2-coat finish system (1.0 mil thick minimum) to both door faces after forming.
 - c. Provide minimum selection of 3 colors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that sectional overhead doors may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies:
 - 1. Immediately notify architect.
 - 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 3. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. Track Assemblies:
 - 1. Slope tracks at proper angle from vertical, or otherwise design to ensure tight closure at jambs when door unit is closed.
 - 2. Weld or bolt to track supports.
 - 3. Fasten vertical track assembly to framing at not less than 24 inches on center.
 - 4. Hang horizontal track from structural overhead framing with angle or channel hangers, bolt-fastened in place.
 - 5. Provide sway bracing, diagonal bracing, and reinforcing as required for rigid installation of track, door-operating equipment.
 - 6. Secure, reinforce, support as required for size; weighted to provide strength, rigidity, to ensure against sag, sway, detrimental vibration during opening, closing of doors.
- B. Safety Protection: Locate electric eyes 6 inches above the floor.

3.03 REPAIR/RESTORATION

- A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance.
- B. Use materials, procedures recommended or furnished by manufacturer.

3.04 ADJUSTING

- A. Upon completion of installation, including work by other trades, lubricate, test, adjust doors to operate easily, free from warp, twist, distortion, fitting weather-tight for entire perimeter.

3.05 CLEANING

- A. System: Clean exposed surfaces of sectional overhead doors using materials and methods recommended by manufacturer.

- B. Labels: Upon completion of cleaning, provide and attach label to each door indicating name of manufacturer and name of installing contractor.

3.06 DEMONSTRATION

- A. Startup Services: Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train owner's representative:
 - 1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
 - 2. Train owner's representative on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventative maintenance.
 - 3. Review data in the "Operating and Maintenance Manual".
- B. Maintenance Instructions: Manufacturer's representative to schedule and attend meeting with owner's representatives to explain:
 - 1. Maintenance and Care Instructions.
 - 2. Recommended Maintenance Program.
 - 3. Warranty Requirements.

SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONT

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Framing System:
 - a. Storefront-type framing system.
 - b. Frames for entrances.
 - 2. Manual Swing Doors:
 - a. Exterior entrance doors.
 - b. Interior vestibule doors.
 - 3. Hardware.
 - 4. Aluminum storefront accessories including, but not limited to:
 - a. Joint sealants for aluminum entrances and storefront.
 - b. Weatherstripping.
- B. Installation of material furnished by other sections including, but not limited to:
 - 1. Finish door hardware (Section 08 71 00).
- C. The following is not included in this section:
 - 1. Lock cylinders (Section 08 71 00).
 - 2. Glazing (Section 08 80 00).

- D. Related Sections:
1. Section 04 20 00 – Unit Masonry Assemblies
 2. Section 04 43 00 – Stone Masonry
 3. Section 07 92 00 - Joint Sealants
 4. Section 08 71 00 - Door Hardware
 5. Section 08 80 00 - Glazing

1.02 REFERENCES

- A. AAMA:
1. 501 - Test Methods for Exterior Walls
 2. 611 - Anodized Architectural Aluminum
 3. 1503.1 - Voluntary test method for thermal transmittance and condensation resistance of window, doors, and glazed wall sections
- B. ADA - U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)"
- C. ASTM:
1. A36 - Carbon Structural Steel
 2. A123 - Zinc Coatings on Iron and Steel Products
 3. A153 - Zinc Coatings on Iron and Steel Hardware
 4. A240 - Chromium and Chromium-Nickel Stainless Steel Plate
 5. A1011 - Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability
 6. B209 - Aluminum and Aluminum Alloy Sheet and Plate
 7. B221 - Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Profiles, and Tubes
 8. B429 - Aluminum Alloy Extruded Structural Pipe and Tube
 9. E84 - Surface Burning Characteristics
 10. E283 - Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 11. E330 - Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Wall by Static Air Pressure Difference
 12. E331 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 13. E783 - Field Measurement of Air Leakage through Installed Exterior Windows and Doors
 14. E1105 - Water Penetration of Windows, Skylights, Doors, Curtain Walls
 15. E1332 - Test for Outdoor-Indoor Transmissions

1.03 DEFINITIONS

- A. CFM: Cubic feet per minute.
- B. PSF: Pounds per square foot.

1.04 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Opening-Force Requirements for Doors:
 - a. Egress doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
 - b. Accessible interior doors: Not more than 5 lbf.
- B. Performance Requirements: Provide system, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural Performance: Maximum deflection of 1/175 span, safety factor of 1.65, able to resist following loads (applied and/or combined according to International Building Code and ASTM E330):
 - a. 30 PSF live load (horizontal projection, including snow load, etc.) plus dead load.
 - b. 30 PSF wind-load (vertical projection, including uplift and shape factors as required) plus dead load.
 - c. Thermal load of approximately 100 degrees from ambient temperature.
 - 2. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/square foot of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/square foot.
 - 3. Water Penetration Under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/square foot.
 - 4. Water Penetration under Dynamic Pressure: No evidence of water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/square foot.
 - 5. Maximum Water Leakage: Per AAMA 501.1, no uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.
 - 6. Condensation Resistance: Where framing systems are "thermal-break" construction, provide units tested for thermal performance according to AAMA 1503.1 showing condensation resistance factor (CRF) of not less than .
 - 7. Thermal Transmittance: Provide framing systems that have an overall U-value of not more than 0.50 BTU/(hour by square feet by degrees F) at 15 mph exterior wind velocity when tested according to AAMA 1503.

1.05 SUBMITTALS

- A. Provide submittals according to requirements of Division 01.
- B. Product Data: Material descriptions, finishes for each type of product indicated, and recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop Drawings by manufacturer for each aluminum entrance and storefront system required, including:
 - 1. Layout and installation details, including relationship and attachments to adjacent work.
 - 2. Elevations at 1/4-inch scale.
 - 3. Dimensions of individual components and profiles.
 - 4. Detail sections of typical composite members.
 - 5. Anchors and reinforcement.
 - 6. Glazing details.
 - 7. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 8. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the interior.
 - 9. For entrances, submit complete hardware schedule organized into sets based on hardware specified.
 - a. Coordinate hardware with doors, frames and related work to ensure proper mounting height, size, thickness, hand, function and finish.
 - b. Include item name, name of manufacturer and complete designations of every item required for each door opening.
- D. Samples:
 - 1. Finish/Color Initial Selection: For units with factory-applied color finishes.
 - 2. Finish/Color Verification: For each type of exposed finish required, in manufacturer's standard sizes.
 - 3. Fabrication: Of each vertical-to-horizontal intersection of systems, made from 12-inch lengths of full-size components and showing details of the following:
 - a. Joinery.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

1.06 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain aluminum entrances and storefront systems from 1 source and from a single manufacturer.

- B. Qualifications:
1. Manufacturer: Provide entrances and storefront produced by a manufacturer with not less than 5 years successful experience in the fabrication of assemblies of the type and quality required.
 2. Installer: Entrances and storefront shall be installed by a firm that has not less than 5 years successful experience in the installation of systems similar to those required, and is acceptable to manufacturer.
 3. Testing Agency: An independent agency qualified according to ASTM E699 for testing indicated.
 4. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code-Aluminum."
- C. Regulatory Requirements:
1. Accessible Entrances: Comply with Accessibility Guidelines for Buildings and Facilities by ADAAG.

1.07 PROJECT CONDITIONS

- A. Field Measurements:
1. Check openings by field measurement before fabrication to ensure proper fitting of work; show measurements on final Shop Drawings.
 2. Coordinate fabrication schedule with construction progress to avoid delay in the work.
 3. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.
- B. Storage and Protection:
1. Protect installed materials from damage by adjacent work.
 2. Protect against scratching and falling debris or equipment.
 3. Damages resulting from work: Immediately repair or replace as necessary to acceptance of architect at no additional cost to owner.
- C. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.08 WARRANTY

- A. Provide manufacturer's standard warranty of material and workmanship, including reglazing, to repair or replace defective units at no cost to owner.
- B. Failures: Include, but are not limited to:
1. Structural failures including, but not limited to, excessive deflection.
 2. Faulty operation of door hardware supplied by this section.
 3. Noise or vibration caused by thermal movements.
 4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

5. Adhesive or cohesive sealant failures.
 6. Water leakage through fixed glazing and framing areas.
 7. Failure of operating components to function properly.
- C. Finish warranty agreeing to repair or replace components on which finish fails:
1. Class I anodized finish: Provide manufacturer's 5-year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Aluminum-Framed Storefront (Heavy Commercial Grade):
1. Standard of Quality: design is based on Series 6000 Thermal Multipane storefront as manufactured by Oldcastle Building Envelope; Terrell, TX
 2. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. CMI Architectural Products, Inc., Minneapolis, MN
www.cmiarch.com
 - b. EFCO Corporation, Monett, MO www.efcocorp.com
 - c. Kawneer Company, Inc., Norcross, GA www.kawneer.com
 - d. Tubelite, Reed City, MI www.tubeliteinc.com
 - e. Member of AAMA, manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated:
1. Sheet and Plate: ASTM B209.
 2. Extruded Bars, Rods, Profiles, Tubes: ASTM B221.
 3. Extruded Structural Pipe and Tubes: ASTM B429.
 4. Structural Profiles: ASTM B308.
 5. Welding Rods and Bare Electrodes: AWS A5.10.
- B. Carbon Steel Reinforcement:
1. Provide manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00, applied immediately after surface preparation and pretreatment.
 2. Structural Shapes, Plates, Bars: ASTM A36.
 3. Cold-rolled Sheet and Strip: ASTM A1008/A1008M.
 4. Hot-rolled Sheet and Strip: ASTM A1011/A1011M.

2.03 FRAMING SYSTEM COMPONENTS

- A. Framing Members:
1. Extruded aluminum of thickness required and reinforced as required to support imposed loads.

2. Construction:
 - a. Poured and debridged: Composite assemblies of 2 separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.
 - b. Glazing Location: Center Set
- B. Fasteners:
 1. Corrosion-resistant, nonstaining, nonbleeding.
 2. Compatible with adjacent materials.
 3. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 4. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners.
 5. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
 6. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.
- C. Brackets and Reinforcements: Where feasible, provide high-strength aluminum brackets and reinforcements with nonstaining, nonferrous shims for aligning system components; otherwise provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A123.
- D. Flashing:
 1. Concealed Flashing: Provide 26-gage minimum dead-soft stainless steel, or 0.026-inch minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other components.
 2. Exposed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
- E. Concrete/Masonry Inserts: Provide concrete and masonry inserts fabricated from cast-iron, malleable iron, or hot-dip galvanized steel complying with ASTM A123.

2.04 GLAZING SYSTEM

- A. Glazing: See Section 08 80 00.
- B. Structural Sealant:
 1. Comply with ASTM C1184.
 2. Neutral-curing silicone formulation.
 3. Compatible with system components.
 4. Specifically formulated and tested for use as a structural sealant.
 5. Color: As selected by architect from manufacturer's full range of colors.

- C. Weatherseal Sealant:
 - 1. Comply with ASTM C920, Type S, Grade NS, Class 25, uses NT, G, A, and O.
 - 2. Neutral-curing silicone formulation.
 - 3. Compatible with structural sealant and other system components with which it comes in contact.
 - 4. Recommended by structural- and weatherseal-sealant and aluminum-framed system manufacturers for this use.
 - 5. Color: Matching structural sealant.
- D. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.
- E. Spaces and Setting Blocks: Manufacturer's standard elastomeric types.
- F. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.05 DOOR HARDWARE

- A. All hardware shall be furnished and installed by Section 08 71 00.
- B. All finish door hardware, except weatherstripping for aluminum entrances, to be furnished by Section 08 71 00 for factory assembly by this section.
- C. Furnish hardware that complies with the requirements of Section 08 71 00.
 - 1. Weatherstripping:
 - a. Provide manufacturer's standard replaceable components.
 - b. Compression type:
 - 1) Exterior doors against fixed stops.
 - 2) Wool pile conforming to AAMA 701.2.
 - c. Provide EPDM or vinyl blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

2.06 ACCESSORIES

- A. Insulating Materials: See Section 07 21 00.
- B. Joint Sealants at perimeter of aluminum-framed systems: See Section 07 92 00.
- C. Bituminous paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos. Formulated for 30-mil thickness per coat.

2.07 FABRICATION

A. Storefront Framing System:

1. Fabricate aluminum entrance and storefront components to designs, sizes and thicknesses indicated and to comply with indicated standards.
2. See Drawings for variable dimensions, with maximum and minimum dimensions required to achieve design requirements and coordination with other work.
3. Provide for flush glazing storefront from the exterior on all sides without projecting stops.
4. Shop-fabricate and preassemble frame components where possible.
5. Form aluminum shapes before finishing.
6. Provide storefront frame sections without exposed seams.
7. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
8. Fabricate components for assembly using shear-block system or screw-spine system or head-and-sill receptor system with shear blocks at intermediate horizontal members. Supplier choice.
9. Perform fabrication operations, including cutting, fitting, welding forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces.
 - a. For hardware, perform these operations prior to application of finishes.
10. Reinforcing: Install reinforcing as required for hardware and necessary for performance requirements, sag resistance and rigidity.
11. Do not drill and tap for surface-mounted hardware items until time of installation at Site.
12. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - d. Physical and thermal isolation of glazing from framing members.
 - e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - f. Provisions for field replacement of glazing from exterior.
 - g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator that will prevent corrosion.

- C. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
 - 1. Mullion Configurations:
 - a. Provide pockets at the inside glazing face to receive resilient elastomeric glazing.
 - b. Mullions and horizontals shall be one piece.
 - c. Make provisions to drain moisture accumulation to the exterior.
 - 2. Thermal-Break Construction:
 - a. Fabricate storefront (not entry doors or entry door frame) framing system with integrally concealed, low conductance thermal barrier, located between exterior materials and exposed interior members to eliminate direct metal-to-metal contact.
 - b. Use manufacturer's standard construction that has been in use for similar projects.

2.08 STILE-AND-RAIL TYPE ALUMINUM DOORS:

- A. Frame: Tubular frame members.
- B. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
- C. Bottom Rail: 12-inch minimum..
- D. Glazing:
 - 1. Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails.
 - 2. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.
 - 3. Glazing stops and gaskets: Square, preformed gaskets.
- E. Design:
 - 1. Provide 1-3/4 inch thick doors of wide stile (over 5 inch width).
- F. Accessibility: Smooth surface for width of door in area within 12 inches above floor or ground plane.

2.09 FINISHES

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes:
 - 1. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

- B. Anodic Finish:
 - 1. Color Anodized Finish: Provide AA 12C22A44, Class 1 (non-specular as fabricated mechanical finish; chemical etch, medium matte; minimum thickness 0.7 mil), integrally or electrolytically deposited colored anodic coating.
 - a. Color:
 - 1) Dark Bronze.

2.10 SOURCE QUALITY CONTROL

- A. Structural-Sealant-Glazed Systems: Perform quality control procedures complying with ASTM C1401 recommendations including, but not limited to, system material qualification procedures, sealant testing, and system fabrication reviews and checks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect, with Installer present, and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that aluminum-framed storefront may be installed according to original design, installation tolerances, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies:
 - 1. Immediately notify architect.
 - 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 3. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Seal joints watertight, unless otherwise indicated.
 - 6. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 7. Install components plumb and true in alignment with established lines and grades, without warp or rack.

- B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
 3. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 4. Paint dissimilar metals where drainage from them passes over aluminum.
 5. Paint wood or similar absorptive material in contact with aluminum and exposed to the elements or otherwise subject to wetting, with 2 coats of aluminum house paint. Seal joints between the materials with sealant.
- C. Hardware Installation:
1. Drill and tap frames and doors and apply surface-mounted hardware items.
 2. Comply with hardware manufacturer's instructions and template requirements.
 3. Use concealed fasteners wherever possible.
- D. Exterior Entrances: Install to produce tight fit at weatherstripping and weathertight closure.
- E. Sealant:
1. Set continuous sill members and flashing in full bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weather tight construction. Comply with requirements of Division 7 for sealants, fillers, and gaskets.
 2. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 3. Install weatherseal sealant according to Section 07 92 00 and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- F. Glazing: Refer to Section 08 80 00 for installation of glass and other panels indicated to be glazed into doors and framing.

3.03 FIELD QUALITY CONTROL

- A. Construction Tolerances: Install aluminum entrance and storefront systems to comply with the following tolerances:
1. Variation from Plane: Do not exceed 1/8 inch in 12 feet of length or 1/4 inch in any total length.
 2. Offset from Alignment: The maximum offset from true alignment between two identical members abutting end to end in line shall not exceed 1/16 inch.

3. Diagonal Measurements: The maximum difference in diagonal measurements shall not exceed 1/8 inch.
 4. Offset at Corners: The maximum out-of-plane offset at corners shall not exceed 1/32 inch.
- B. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare field reports.
 - C. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - D. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
 - E. Additional testing and inspecting, at contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.04 ADJUSTING

- A. Adjust operating hardware to function properly, for smooth operation without binding, and for weather tight closure.
- B. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

3.05 CLEANING

- A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.
- B. Clean glass surfaces after installation, complying with requirements contained in Section 08 80 00 for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.06 PROTECTION

- A. Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 CONDITIONS

- A. Conditions of the contract (General and Supplementary Conditions) and Division One 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 according to 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 (for hollow metal and aluminum doors) 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)
- 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 architect 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 8 Section "Hollow Metal Doors and Frames".
 - 2. Division 8 Section "Aluminum Entrances and Storefronts"
 - 3. Division 28 Sections "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. IBC 2012 - International Building Code 2006 Edition (as 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 1 - General Conditions.
- 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) employed by the hardware distributor. The hardware schedule shall be signed and embossed with the DHI certification seal of the supervising AHC. The supervising AHC shall attend any meetings related to the project when requested by the architect.
- 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 in compatible 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 1 - General Conditions.
- I. Submit a sample of each type of hardware requested by the architect. 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 1 - General Conditions.
- 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 the 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 1 - General Conditions. Wiring diagrams shall be included in final submittals transmitted for distribution and 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 architect, provided the required data and physical samples are submitted for approval as set forth in Division One 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 architect.

- C. Obtain each type of hardware (hinges, latch and 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 architect 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. Coordinate with contractor prior to hardware delivery and recommend secure storage and protection against loss and damage at job site.
- D. 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 architect and hardware supplier immediately after receipt of material at the job site.

- E. 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: Architect, contractor, Door Hardware Installers (including low voltage hardware), Manufacturers 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 One 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 architect 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	1279	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 inch 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 8 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 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.
- 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:
- | | | |
|---|-----------------|--------------------|
| 1 | 5" x 5" | 2-1/4" thick doors |
| 2 | 4-1/2" x 4-1/2" | 1-3/4" thick doors |
| 3 | 3-1/2" x 3-1/2" | 1-3/8" thick doors |
- H. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.
- I. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior and out-swinging interior doors.
- J. Unless otherwise specified, furnish all hinges to template standards.

2.3 CONTINUOUS PIN AND BARREL HINGES

A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Marker</u>	<u>Stanley</u>	<u>McKinney</u>
1 Edge Mount Pin and Barrel Stainless Steel Continuous Hinge	700 Series	300 Series	650 Series	300 Series

- A. Hinges shall be independently certified by ANSI for compliance with ANSI A156.26, Grade 1 (2012).
- B. 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).
- C. 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.
- D. 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.
- E. Each knuckle to be 2 inch, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.
- F. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours.
- G. Provide machine screws for doors which have been reinforced to accept machine screws.
- H. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.

2.4 POWER TRANSFERS

A. Acceptable manufacturers and respective catalog numbers:

	<u>Von Duprin</u>
1 Concealed Two Wire	EPT-2

- 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>
1 Dust Proof Strike	DP2	80	280X
2 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 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>Detex</u>
1 Wide Stile, Push Pad	98 / 99 Series	Advantex (Wide Stile)
2 Lever Trim	996 Series	"D/DM" Trim
3 Pull Trim	990 Series	"C" Trim

- B. Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3, Grade 1 (2008).
- C. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.
- E. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.
- F. All exit devices shall be provided with flush end caps to reduce potential damage from impact.
- G. All exit devices shall be provided with dead-locking latch bolts to ensure security.
- H. 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.

- I. 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.
- J. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide through bolts as required.
- K. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)
- L. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.
- M. Unless specific exit device dogging options are noted within hardware sets, provide dogging options as follows:
- N. Fire Rated devices: Dogging not permitted.
- O. Non-Rated Exit Only functions not equipped with outside trim or pull: Less Dogging.
- P. Non-Rated Classroom functions: Less Dogging.
- Q. Non-Rated devices utilizing electric latch retraction or electrified outside trim: Less Dogging.
- R. All Other Non-Rated devices: Cylinder Dogging utilizing interchangeable core cylinders. Cylinder keyway shall match locksets furnished on this project.
- S. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
- T. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
- U. 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>Best</u>	<u>Sargent</u>
1 Grade 1 Mortise	L Series 03A	45H Series 3H	8200 LNJ
- B. Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2011). Interconnected locks shall be independently certified by ANSI for compliance with ANSI A156.12 (2013). Mortise locks shall be independently certified by ANSI for compliance with ANSI A156.13 (2012).

- 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. 6 pin cylinders
 - 5. ANSI A115.2 strikes
- D. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.
- E. Length of strike lip shall be sufficient to clear surrounding trim.
- F. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

2.8 PULLS, PUSH BARS, PUSH/PULL PLATES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Burns</u>	<u>Hager</u>	<u>Ives</u>
1 Offset Door Pull (1" dia., 10" ctc)	39C	12J	8190-0
2 Pull / Push-Bar (1" dia., 10" ctc Pull)	422 x 26C	153	9103-0
3 Offset Pull / Push-Bar (1" dia., 10" ctc Pull)	422 x 39C	159	9190-0
4 Push Plate (.050 4"X 16")	54	30S 4 x 16	8200 4 x 16
5 Push Plate (.050 6"X 16")	56	30S 6 x 16	8200 6" X 16"
- A. 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. 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 and rail or full glass doors.

2.9 CLOSERS

- A. Acceptable manufacturers and respective catalog numbers:

<u>LCN</u>	<u>Sargent</u>
1 4011 /4111 EDA	281 / 281P10
- 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. Provide "SPECIAL TEMPLATE - #1728 / #0723" closer arms as required to accommodate aluminum frame head details with "non-structural stops" when closers will be required to utilize parallel arm mounting positions. Frame mounting shoe shall be shortened, and pivot hub height shall be increased to permit frame mounted shoe to be positioned on frame rabbit (rather than the frame stop), and behind the frame stop rather than on top of the frame stop. Contact LCN Door Closers at: 877-671-7011 for pricing and design assistance.
- G. Closers shall use high strength cast iron cylinders, forged main arms, and 1 piece forged steel pistons.
- H. Closers shall utilize a stable fluid withstanding temperature range of +120deg F to -30deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
- I. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
- J. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
- K. 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.
- L. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
- M. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
- N. 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.
- O. Pressure Relief Valve, PRV, shall not be acceptable.

2.10 LOW ENERGY ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>LCN</u>
1 Electro-Hydraulic Operator	4640
- 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. The closing action shall be controlled by modern type cast iron door closer cylinder filled with a flat viscosity fluid, stable from +120F to -30F that would require no seasonal adjustments. The closer shall have field adjustable spring power; have two independent closing speed adjustment valves, and hydraulic back-check.
- E. Full closing force shall be provided when the power or assist cycle ends.
- F. All power operator systems shall include the following features and functions:
 - 1. Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical Code, section 725-31.
 - 2. The operator will be designed with an electronically controlled mechanical clutching mechanism to prevent damage to the operator if the system is actuated while the door is latched or if the door is forced closed during the opening cycle.
 - 3. All covers, mounting plates and arm systems shall be powder coated and successfully pass a minimum of 100 hours testing as outlined in ANSI/BHMA Standard A156.18.
 - 4. UL listed for use on labeled doors.
 - 5. All operators shall be non-handed with spring power over a range of at least four sizes; either 1 through 4 or 2 through 5.
 - 6. The power operator shall incorporate microprocessor controlled digital controls including: factory default memory settings, on-board diagnostics, non-volatile memory, and integrated delay and relay for controlling door release devices.
 - 7. Provisions in the control box or module shall provide control {inputs and outputs) for; electric strike delay, auxiliary contacts, sequential operation, fire alarms systems, actuators, swing side sensors, and stop side sensors.
 - 8. Wall mounted actuators shall consist of a 4-1/2 inch diameter stainless steel touch plate with a blue filled handicapped symbol. Switches shall be weather resistant and mount on a single gang electrical box furnished by Division 16.
- G. All electrically powered operators shall include the following features or functions:
 - 1. When an obstruction or resistance to the opening swing is encountered, the operator will pause at that point, then attempt to continue opening the door. If the obstruction or resistance remains, the operator will again pause the door.
 - 2. Easily accessible main power and maintain hold open switches will be provided on the operator.
 - 3. An electronically controlled clutch to provide adjustable opening force.
 - 4. A microprocessor to control all motor and clutch functions.
 - 5. An on-board power supply capable of delivering both 12V and 24V outputs up to a maximum of 1.0 ampere combined load.

- 6. All input and output power wiring shall be protected by slow blow fuses. These fuses shall be easily replaceable without special tools or component replacement.
- 7. If electrical failure occurs, the unit shall operate as a standard door closer.
- H. 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. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing.
- D. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
- E. 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>
1 Heavy Duty Surface Mount	GJ900 Series	9 Series	590
2 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>
1 Wrought Concave Wall Bumper	WS406CCV	236W	575
2 Automatic Wall Holder	WS40	326W	533

- B. Furnish a stop or holder for all doors. Furnish floor stops or hinge pin stops only where specifically specified.
- C. Where wall stops are not applicable, furnish overhead stops.
- D. 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>
1 Weatherstrip	429	2891_PK	700NA	755
2 Adhesive Gasket	188	S88	5050	797
3 Mullion Seal/Silencer	8780	5110	5100N	
4 Sweep w/ drip	8198	345_N	C627	354
5 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.
- 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>
1 Saddle Thresholds	8655	171	425	S205
2 Half Saddle Thresholds	1674	227	324	S239
3 Interlocking Threshold	74A	114	442-5	T550

- A. Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2001).
- B. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to ensure a smooth transition between threshold and interior floor finish.
- C. Threshold Types:
 - 1. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
 - 2. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

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 AND BASE MATERIAL</u>
1 Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
2 Butt Hinges: Interior	652 (US26D - Satin Chromium)
3 Continuous Hinges	630 (US32D - Satin Stainless Steel)
4 Flush Bolts	626 (US26D - Satin Chromium)
5 Exit Devices	626 (US26D - Satin Chromium)
6 Locks and Latches	626 (US26D - Satin Chromium)
7 Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
8 Closers	689 (Powder Coat Aluminum)
9 Protective Plates	630 (US32D - Satin Stainless Steel)
10 Overhead Stops	630 (US32D - Satin Stainless Steel)
11 Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
12 Thresholds	628 (Mill Aluminum)
13 Weather-strip, Sweeps Drip Caps (wood and hollow metal doors)	Aluminum Anodized
14 Weather-strip, Sweeps Drip Caps (aluminum doors)	Match finish of aluminum doors.
15 Miscellaneous	626 (US26D - Satin Chromium)

2.17 KEYING

- A. Acceptable manufacturers and respective catalog numbers:

<u>Schlage</u>	<u>Sargent</u>	<u>Best</u>
1 Everest 29	Signature	
- B. Provide all locks and cylinders utilizing a patented keyway to prevent manufacturing and distribution of aftermarket key blanks by anyone other than factory authorized dealers.

- C. All locks under this section shall be keyed as directed by the owner to a new Restricted Patented Grand Master Key System.
- D. Keying shall be by lock manufacturer where permanent records shall be kept.
- E. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.
- F. Master keys and control keys to be delivered by registered mail to the owner. Change keys shall be delivered in a set up key cabinet. Construction keys shall be delivered to the contractor.

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. Install all hardware according to the approved hardware schedule and manufacturers instructions for installation and adjustment.
- C. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.
- E. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.
- F. Shim doors as required to maintain proper operating clearance between door and frame.
- G. Unless otherwise specified, locate all hardware according to the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.

- H. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.
- I. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.
- J. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.
- K. Install hardware on UL labeled openings according to manufacturer's requirements to maintain the label.
- L. Apply self-adhesive gasketing on frame stop at head and latch side and on rabbet of frame at hinge side.
- M. Install hardware according to 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", and "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 1 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 and manufacturers representative 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 manufacturers 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
1	EA	IC CYLINDER	AS REQUIRED	SCH

HW SET 02

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	700	IVE
1	EA	CONT. HINGE	700 EPT	IVE
1	EA	POWER TRANSFER	EPT2	VON
1	EA	KEYED REMOVABLE MULLION	KR4954 X STAB	VON
4	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	PANIC HARDWARE	CD-99-EO	VON

1	EA	ELEC PANIC HARDWARE	LX-CD-99-NL-OP	VON
2	EA	90 DEG OFFSET PULL	8190 10"	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR	8310-856	LCN
1	EA	RAIN DRIP	142A	ZER
1	EA	WEATHERSTRIP	BY DR/FR SUPPLIER	ZER
2	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	8655	ZER

OPERATIONAL DESCRIPTION

MULLION REMOVABLE BY KEY.

FREE EGRESS AT ALL TIMES. PRESSING PUSH BAR RETRACTS LATCHBOLTS. NO EXTERIOR TRIM. DOGGING BY KEY CYLINDER LOCKS DOWN THE PUSHBAR OR CROSSBAR SO THE LATCHBOLT REMAINS RETRACTED.

FREE EGRESS AT ALL TIMES. PRESSING PUSH BAR RETRACTS LATCHBOLTS. TRIM ALWAYS LOCKED, ENTRANCE BY OPTIONAL TRIM WHEN KEY RETRACTS LATCHBOLT FROM PULL SIDE. ONE INTERNAL SPDT SWITCH MONITORS THE LATCHBOLT POSITION. DOGGING BY KEY CYLINDER LOCKS DOWN THE PUSHBAR OR CROSSBAR SO THE LATCHBOLT REMAINS RETRACTED.

SELF-CLOSING.

AUTOMATICALLY OPENS and CLOSES DOOR.

HW SET 03

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	MANUAL FLUSH BOLT	MANUAL	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	STOREROOM W/DEADBOLT	L9480	SCH
1	EA	OH STOP AND HOLDER	90H INACTIVE LEAF	GLY
1	EA	SURFACE CLOSER	4111 SHCUSH	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	IVE
1	EA	RAIN DRIP	142A	ZER
1	EA	WEATHERSTRIP	429A	ZER
1	EA	ASTRAGAL	BY DR SUPPLIER	B/O
2	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	8655	ZER

MOUNT WEATHERSTRIP BEFORE CLOSER. PROVIDE CLOSER WITH SPECIAL TEMPLATE.

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KEY OUTSIDE OR BY LEVER OR KNOB INSIDE. OUTSIDE KNOB/LEVER ALWAYS FIXED. DEADBOLT THROWN OR RETRACTED BY KEY OUTSIDE OR THUMBTURN INSIDE. TURNING INSIDE KNOB/LEVER SIMULTANEOUSLY RETRACTS BOTH DEADBOLT AND LATCHBOLT. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

SELF-CLOSING. TEMPLATING ALLOWS SPRING CUSH ARM TO STOP THE DOOR'S SWING BETWEEN 85 AND 110 DEGREES WITH HOLD-OPEN FEATURE.

HW SET 04

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	CONT. HINGE	700	IVE
2	EA	90 DEG OFFSET PULL	8190 10"	IVE
2	EA	PUSH BAR	9100	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4111 EDA	LCN
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR	8310-856	LCN

OPERATIONAL DESCRIPTION

SELF-CLOSING.

AUTOMATICALLY OPENS and CLOSES DOOR.

HW SET 05

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
2	EA	MANUAL FLUSH BOLT	MANUAL	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	CLASS SEC W/DB X INSIDE IND	L9458 X L283-711	SCH
1	EA	OH STOP AND HOLDER	90H INACTIVE LEAF	GLY
1	EA	SURFACE CLOSER	4111 SHCUSH	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	IVE
1	EA	RAIN DRIP	142A	ZER
1	EA	WEATHERSTRIP	429A	ZER
1	EA	ASTRAGAL	BY DR SUPPLIER	B/O
2	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	8655	ZER

MOUNT WEATHERSTRIP BEFORE CLOSER. PROVIDE CLOSER WITH SPECIAL TEMPLATE.

OPERATIONAL DESCRIPTION

LATCHBOLT OPERATED BY LEVER FROM EITHER SIDE EXCEPT WHEN OUTSIDE LEVER IS LOCK FROM INSIDE OR OUTSIDE BY KEY. DEADBOLT RETRACTED BY KEY FROM INSIDE OR OUTSIDE. OPERATING INSIDE LEVER RETRACTS BOTH BOLTS AND UNLOCKS OUTSIDE. AUXILIARY DEADLATCH WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS. LOCK INDICATOR WILL READ LOCKED/UNLOCKED

SELF-CLOSING. TEMPLATING ALLOWS SPRING CUSH ARM TO STOP THE DOOR'S SWING BETWEEN 85 AND 110 DEGREES WITH HOLD-OPEN FEATURE.

HW SET 06

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	CONTINUOUS HINGE	700	IVE
1	EA	PANIC HARDWARE	LD-99-EO	VON
1	EA	SURFACE CLOSER	4111 SCUSH	LCN
1	EA	RAIN DRIP	142A	ZER
1	EA	WEATHERSTRIP	429A	ZER
1	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	8655	ZER

OPERATIONAL DESCRIPTION

FREE EGRESS AT ALL TIMES. PRESSING PUSH BAR RETRACTS LATCHBOLTS. NO EXTERIOR TRIM. NO DOGGING INCLUDED.

SELF-CLOSING. TEMPLATING ALLOWS SPRING CUSH ARM TO STOP THE DOOR'S SWING BETWEEN 85 AND 110 DEGREES.

HW SET 07

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	KEYPAD TRIM	CO-100-MS-70-KP	SCH
1	EA	SURFACE CLOSER	4111 SHCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	RAIN DRIP	142A	ZER
1	EA	WEATHERSTRIP	429A	ZER
1	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	8655	ZER

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KEY OUTSIDE OR BY LEVER OR KNOB INSIDE. OUTSIDE KNOB/LEVER ALWAYS FIXED. DEADBOLT THROWN OR RETRACTED BY KEY OUTSIDE OR THUMBTURN INSIDE. TURNING INSIDE KNOB/LEVER SIMULTANEOUSLY RETRACTS BOTH DEADBOLT AND LATCHBOLT.

AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

SELF-CLOSING. TEMPLATING ALLOWS SPRING CUSH ARM TO STOP THE DOOR'S SWING BETWEEN 85 AND 110 DEGREES WITH HOLD-OPEN FEATURE.

HW SET 08

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSRM DEAD LOCK W/ADD TT	L463 X L583-363	SCH
1	EA	90 DEG OFFSET PULL	8190 10"	IVE
1	EA	PUSH PLATE	8200 4" X 16"	IVE
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WALL STOP/HOLDER	WS40	IVE

OPERATIONAL DESCRIPTION

DEADBOLT THROWN OR RETRACTED BY KEY FROM OUTSIDE. INSIDE THUMBTURN CYLINDER RETRACTS DEADBOLT BUT CANNOT PROJECT IT.

SELF-CLOSING.

HW SET 09

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PRIVACY W/OUTSIDE OCC IND	L9040 X L283-722	SCH
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WALL STOP	WS406/407CCV	IVE
1	EA	GASKETING	188S	ZER

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KNOB/LEVER FROM EITHER SIDE UNLESS OUTSIDE IS LOCKED BY INSIDE THUMBTURN. TURNING INSIDE KNOB/LEVER OR CLOSING DOOR UNLOCKS OUTSIDE KNOB/LEVER. TO UNLOCK FROM OUTSIDE, REMOVE EMERGENCY BUTTON, INSERT EMERGENCY THUMBTURN(FURNISHED) IN ACCESS HOLE AND ROTATE. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS. LOCK INDICATOR WILL READ OCCUPIED/VACANT

SELF-CLOSING.

HW SET 10

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	WALL STOP	WS406/407CCV	IVE

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KNOB/LEVER FROM EITHER SIDE UNLESS OUTSIDE IS LOCKED BY KEY. UNLOCKED FROM OUTSIDE BY KEY. INSIDE KNOB/LEVER ALWAYS FREE FOR IMMEDIATE EXIT. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

HW SET 11

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	OH STOP	90S	GLY

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KNOB/LEVER FROM EITHER SIDE UNLESS OUTSIDE IS LOCKED BY KEY. UNLOCKED FROM OUTSIDE BY KEY. INSIDE KNOB/LEVER ALWAYS FREE FOR IMMEDIATE EXIT. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

HW SET 12

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WALL STOP	WS406/407CCV	IVE

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KNOB/LEVER FROM EITHER SIDE UNLESS OUTSIDE IS LOCKED BY KEY. UNLOCKED FROM OUTSIDE BY KEY. INSIDE KNOB/LEVER ALWAYS FREE FOR IMMEDIATE EXIT. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

SELF-CLOSING.

HW SET 13

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	SURFACE CLOSER	4011	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WALL STOP	WS406/407CCV	IVE
1	EA	GASKETING	188S	ZER

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KNOB/LEVER FROM EITHER SIDE UNLESS OUTSIDE IS LOCKED BY KEY. UNLOCKED FROM OUTSIDE BY KEY. INSIDE KNOB/LEVER ALWAYS FREE FOR IMMEDIATE EXIT. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

SELF-CLOSING.

HW SET 14

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	KEYPAD TRIM	CO-10-MS-70-KP	SCH
1	EA	SURFACE CLOSER	4111 SHCUSH	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KNOB/LEVER FROM EITHER SIDE UNLESS OUTSIDE IS LOCKED BY KEY. UNLOCKED FROM OUTSIDE BY KEY. INSIDE KNOB/LEVER ALWAYS FREE FOR IMMEDIATE EXIT. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

SELF-CLOSING. TEMPLATING ALLOWS SPRING CUSH ARM TO STOP THE DOOR'S SWING BETWEEN 85 AND 110 DEGREES WITH HOLD-OPEN FEATURE.

HW SET 15

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	L9070	SCH
1	EA	SURFACE CLOSER	4011 H	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	IVE
1	EA	WALL STOP	WS406/407CCV	IVE

OPERATIONAL DESCRIPTION

LATCHBOLT RETRACTED BY KNOB/LEVER FROM EITHER SIDE UNLESS OUTSIDE IS LOCKED BY KEY. UNLOCKED FROM OUTSIDE BY KEY. INSIDE KNOB/LEVER ALWAYS FREE FOR IMMEDIATE EXIT. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS LOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

SELF-CLOSING. FRICTION HOLD-OPEN FEATURE ALLOWS THE DOOR TO BE HELD-OPEN AT A SPECIFIC DEGREE OF SWING.

SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Primary glass products:
 - a. Clear float.
 - 2. Heat-treated glass products:
 - a. Tempered.
 - 3. Sealed insulating glass units.
 - 4. High performance coatings (Low "E").
 - 5. Silk screen coatings.
 - 6. Glass and glazing accessories.
- B. Related Sections:
 - 1. Section 08 11 13 - Hollow Metal Doors and Frames (Commercial)
 - 3. Section 08 43 13 - Aluminum-Framed Storefront

1.02 REFERENCES

- A. ASTM:
 - 1. ASTM C 1036 Standard Specification for Flat Glass
 - 2. ASTM C 1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
 - 3. ASTM C 1172 Standard Specification for Laminated Architectural Flat Glass
 - 4. ASTM C 1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
 - 5. ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation
 - 6. ASTM E 546 Standard Test Method for Frost/Dew Point of Sealed Insulating Glass Units
 - 7. ASTM E 576 Standard Test Method for Frost/Dew Point of Sealed Insulating Glass Units in the Vertical Position
 - 8. ASTM E 1300 Standard Practice for Determining Load Resistance of Glass in Buildings
 - 9. ASTM C 1349 Standard Specification for Architectural Flat Glass Clad Polycarbonate
 - 10. CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials
- B. FGMA - Glazing Manual
- C. IGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units
- D. U.S. Consumer Product Safety Commission, 16 CFR 1201 - Safety Standard for Architectural Glazing Materials

1.03 DEFINITIONS

- A. Lites: Interior glazed openings.

1.04 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following:
 - a. Defective manufacture, fabrication, and installation.
 - b. Failure of sealants or gaskets to remain watertight and airtight.
 - c. Deterioration of glazing materials.
 - d. Other defects in construction
- B. Performance Requirements:
 - 1. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
 - a. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
 - b. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal 1/2-inch-wide interspace.
 - c. Center-of-glass values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - 1) U-factors: NFRC 100 expressed as Btu/square foot times height times degree F.
 - 2) Solar heat gain coefficient: NFRC 200.
 - 2. Solar Optical Properties: NFRC 300.

1.05 SUBMITTALS

- A. Make submittals according to Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings: Submit Shop Drawings for each type of glass showing system fabrication, installation drawings, including plans, elevations, sections, details of components, joint locations and configurations within system and between system and adjoining system.
- D. Samples: Submit manufacturer's standard color samples with Product Data and Shop Drawings.
- E. Certifications: Provide manufacturer's product certificate that products furnished comply with requirements.

- F. Test Reports:
1. Preconstruction Adhesion and Compatibility Test Report: Provide from glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.06 QUALITY ASSURANCE

- A. One Source Responsibility: Provide glass and glazing units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
1. Manufacturer: 5 years experience in the manufacture of glass and glazing.
 2. Contractor: 3 years experience in the installation of glass and glazing.
 3. Personnel: For actual installation of glass and glazing, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of Work.
- C. Regulatory Requirements:
1. Consumer Products Safety Commission: Glazing shall comply with 16 CRF Part 1201: Safety Standard for Architectural Glazing Materials
 2. Insulating glass shall be certified under IGMA-approved program.
- D. Testing:
1. Glass Product Testing: Obtain from a qualified testing agency based on testing glass products.
 2. Sealant Product Testing: Obtain from a qualified testing agency based on testing current sealant formulations within a 36 month period.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.08 PROJECT CONDITIONS

- A. Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet.
- B. Do not install liquid glazing sealants when ambient and substrate temperature conditions are below 40 degrees F.

1.09 WARRANTY

- A. Provide 10-year written warranty, beginning at date of substantial completion, covering labor, materials for replacement of spontaneous failure of all tempered glass used on Project.

- B. For any glass requiring replacement under this warranty, provide a new minimum 5 year warranty commencing at date of acceptance of replacement glass by owner and Architect.
- C. Hermetically sealed insulating glass: Submit written warranty agreeing to replace units which fail to maintain hermetic seal of air space, deteriorate, or otherwise fail to perform as required within 10 years after date of Substantial Completion as a result of failure of materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass: Subject to compliance with requirements, acceptable fabricators and products are:
 - 1. Cardinal Glass, Northfield, MN www.cardinalcorp.com
 - 2. Oldcastle Glass Wausau, WI www.oldcastleglass.com
 - 3. Viracon, Owatonna, MN www.viracon.com
 - 4. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 MATERIALS

- A. Primary Glass Products:
 - 1. Annealed Float Glass:
 - a. ASTM C1036, Type I (transparent glass, flat).
 - b. Quality Q3 (glazing select).
- B. Heat-Treated Glass Products:
 - 1. ASTM C1048; Type I (transparent flat glass).
 - 2. Quality Q3 (glazing select).
 - 3. Tempered Glass: ASTM C1048, Provide tempered float glass required by safety of CPSC 16 CFR 1201, other codes and regulations, where safety glass is indicated.
 - 4. Heat Strengthened Glass: Categories 1 and 2 and ANSI 297.1-1984.
- C. Insulated Glass: ASTM E2190, factory-assembled units of sealed lites of glass separated by dehydrated argon-filled interspace; with primary and secondary sealing systems and Low-E coatings.

2.03 GLAZING SCHEDULE

- A. Insulating, low-E glass units (GL-1):
 - 1. General: preassembled units consisting of dual-sealed lites of glass separated by a dehydrated-interspaces.
 - 2. Composition: 1-inch-thick, Low "E" argon filled insulating glass.
 - 3. Edge condition: organic sealed edges.
 - 4. Glazing: 2 panels, 1/4-inch-thick clear HS each.
 - 5. Coating: Low-E on #2 surface.

6. U value of 0.29 (winter) or better.
 7. U-value of 0.26 (summer) or better.
 8. SHGC: 0.38 or better.
 9. Product: VE1-2M as manufactured by Viracon.
- B. Insulating, low-E, tempered glass units (GL-2):
1. General: preassembled units consisting of dual-sealed lites of glass separated by a dehydrated-interspaces.
 2. Composition: 1-inch-thick, Low "E" argon filled insulating glass.
 3. Edge condition: organic sealed edges.
 4. Glazing: 2 panels, 1/4-inch-thick clear HS each.
 5. Coating: Low-E on #2 surface.
 6. Tempered.
 7. U value of 0.29 (winter) or better.
 8. U-value of 0.26 (summer) or better.
 9. SHGC: 0.38 or better.
 10. Product: VE1-2M as manufactured by Viracon.
- C. Clear, tempered glass units (GL-3):
1. Composition: 1/4-inch thick clear HS
 2. Tempered.
- D. Insulating, low-E, silk screened glass units (GL-4):
1. General: preassembled units consisting of dual-sealed lites of glass separated by a dehydrated-interspaces.
 2. Composition: 1-inch-thick, argon filled insulating glass.
 3. Edge condition: organic sealed edges.
 4. Glazing: 2 panels, 1/4-inch-thick clear HS each.
 5. Coating: Low-E on #2 surface.
 6. Silk screen: 55-percent light transmittance.
 7. Product: V1086 frit pattern as manufactured by Viracon.
- E. Accessories: Glazing accessories, other material not specifically called for, to be new, first quality of respective kinds, subject to approval of architect.
1. Sealant:
 - a. Acid-curing silicone.
 - b. Compatible with other sealants and other materials they will contact.
 2. Glazing Tape:
 - a. 1/8 inch at interior lites in hollow metal frames or as recommended by glazing manufacturer.
 - b. Nonstaining and nonmigrating in contact with nonporous surfaces.
 3. Glazing Gaskets:
 - a. Neoprene glazing gaskets of profiles indicated.
 - b. Manufactured from virgin neoprene compounded to meet physical properties of ASTM C542.
 - c. Provide gaskets and zipper lock strips with premolded corners (cut strips of gasket material not acceptable).

4. Aluminum Extrusions:
 - a. 6063-T5 alloy aluminum extrusions for glazing gasket frame sections.
 - b. Finish architectural Class I anodic coating AA-M12 C22 A42 black.
5. Setting Blocks:
 - a. Neoprene with Shore, Type A hardness of 80 to 90 durometer.
 - b. Not less than 3 inches long nor more than 8 inches long; length such that loading is 15 psi.
 - c. Full width of rabbet where possible.
6. Spacer Blocks:
 - a. Elastomeric continuous extrusion or neoprene with Shore, Type A hardness of 40 to 50 durometer.
 - b. 1 inch to 3 inches long.
7. Other Materials: Other materials not specifically described but required for complete, proper installation of glass and glazing, subject to acceptance of architect.

2.04 FABRICATION

- A. Fabricate glass to sizes required for glazing openings, with edge clearances and tolerances complying with glass manufacturer's recommendations.
- B. Provide thickness indicated or, if not indicated, as recommended by glass manufacturer for application indicated.
- C. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- D. Grind smooth and polish exposed glass edges and corners.

2.05 FINISHES

- A. Colors of glazing materials exposed to view in finished work shall be selected from manufacturer's standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that Work is complete to point where this installation may properly commence.
- B. Verification of Conditions:
 1. Verify that glazing may be done according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
 2. Examine for compliance:
 - a. Manufacturing and installation tolerances, including those for size, squareness, and offsets and corners.
 - b. Presence and functioning of weep system.

- c. Minimum required face or edge clearances.
 - d. Effective sealing between joints of glass-framing members.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved.

3.02 PREPARATION

- A. Protect installed work and materials of other trades.
- B. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- C. Protect glass edges from damage during handling and installation. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

3.03 INSTALLATION

- A. Glazing:
 - 1. Install according to referenced standards.
 - 2. Set glass in true plane, tight, straight, with proper, adequate clearance.
 - 3. Install glazing from interior only. No exterior glazing permitted.
 - 4. Locate setting blocks at quarter points of sill; set in sealant if heel or toe bead is required.
 - 5. Install aluminum gasket frames in bed of acoustic sealant.
 - 6. Install spacers inside and out except where preshimmed tape or glazing gaskets are to be used.
 - 7. Firmly anchor to prevent rattling and looseness.
 - 8. Cleanly cut edges, do not nip or seam.
 - 9. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel.
 - 10. Do not leave voids in glazing channels except as specifically indicated or recommended by glass manufacturer.
 - a. Force sealant into channel to eliminate voids.
 - b. Tool exposed surfaces to slightly wash away from joint.
 - c. Trim and clean promptly.
 - d. Do not allow sealant to close weeps of aluminum framing.

3.04 CLEANING AND PROTECTION

- A. Site:
 - 1. Do not allow accumulation of scraps, debris arising from Work of this Section.
 - 2. Maintain premises in neat, orderly condition.
 - 3. Separate and recycle float glass, tempered glass, plastic materials, and corrugated cardboard.
- B. Glass and Glazing:

1. Correct imperfections and replace glass damaged during construction period.
2. Leave labels on glass until it has been inspected and approved. Remove non-permanent labels immediately thereafter.
3. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass.
4. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter.
5. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction for buildup of dirt, scum, alkaline deposits, or stains. Remove as recommended by glass manufacturer.
6. Wash glass on both exposed surfaces not more than 4 days before date scheduled for Substantial Completion inspection. Wash glass as recommended by glass manufacturer.

SECTION 08 90 00 - LOUVERS AND VENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide metal wall louvers exposed to view in finish work, including:
 1. Aluminum louvers.
 2. Louver accessories including, but not limited to:
 - a. Bird screens.
 - b. Insulated "Blank-Off" panels.
- B. Related Sections:
 1. Section 06 10 00 – Rough Carpentry
 2. Section 07 46 46 – Mineral-Fiber Cement Siding
 3. Section 07 92 00 - Joint Sealants

1.02 REFERENCES

- A. AMCA Standard 500 - Test Method for Louvers, Dampers, and Shutters
- B. ASTM:
 1. B209 - Aluminum and Aluminum-Alloy Sheet and Plate
 2. B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, Tubes
 3. E90 - Airborne Sound Transmission

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements:
 1. Withstand loads in compliance with Air Movement and Control Association (AMCA) Standard 500.

2. Maintain performance criteria stated by manufacturer without defects, damage, or failure.
3. Comply with airborne sound transmission loss ratings per ASTM E90.

1.04 SUBMITTALS

- A. Provide submittals according to Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings: Submit Shop Drawings showing system fabrication, installation drawings, including elevations, sections details of components, within system and between system and adjoining system.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide louver units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
 1. Manufacturer: 5 years' experience in the manufacture of louvers.
 2. Personnel: For actual installation of louvers, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.
 3. Welders:
 - a. Aluminum: AWS D1.2.
- C. Certifications: Louvers shall bear the AMCA Certified Ratings Seal for both air performance and water penetration.

1.06 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 WARRANTY

- A. Provide manufacturer's written 1-year warranty for materials and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Standard of Quality: Design is based on products of Industrial Louvers, Delano, MN www.industriallouvers.com

- B. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
1. Airline by Nystrom Building Products, Minneapolis, MN www.nystrom.com
 2. Airolite Co., Marietta, OH www.airolite.com
 3. American Warming and Ventilating (AWV) www.awv.com
 4. Ruskin, Grandview, MO www.ruskin.com
 5. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Aluminum Louvers:
1. Heavy duty, weather-resistant.
 2. Sheet: ASTM B209 alloy 3003 or 5005 with temper as required for forming or recommended by metal producer to provide required finish.
 3. Extrusions: ASTM B221, 0.081-inch extruded aluminum 6063-T5 alloy.

2.03 COMPONENTS

- A. Louvers:
1. Extruded aluminum sections:
 - a. Reinforcing bosses, heads, sills, jambs.
 - b. One-piece structural members, with integral caulking slots and retaining beads.
 - c. Provide invisible mullions as required.
 2. Perimeter frame: Continuous channel frame; exposed surfaces matching louver finish.
 3. Free area: 52 percent minimum.
 4. Model: Model 458XP, 4-inch-deep or equal.
 5. See drawings for louver sizes.
- B. Louver Accessories:
1. Bird Screens:
 - a. Aluminum louvers: 1/2-inch mesh, 0.063 aluminum wire.
 - b. Secure in removable frames on inside of louver.
 - c. All exterior locations unless indicated otherwise.
 2. Insulated "Blank-Off" Panels: As needed, 1-inch polyisocyanurate core faced with 0.032-inch sheet aluminum finished two sides same as louver. Include 0.063-inch extruded aluminum perimeter frame.
 3. Fasteners:
 - a. Aluminum: Stainless steel screws and fasteners.
 4. Other Materials: Other materials not specifically described but required for complete, proper installation of louver, subject to acceptance of architect.

2.04 FABRICATION

- A. All-welded construction with frame and blades welded in place.

2.05 FINISH

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
 - 1. Anodic Finish:
 - a. Color anodized finish: AA-M12C22A44, Class I.
 - b. Color: Dark Bronze.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing Work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that louvers may be installed according to original design, pertinent codes, regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. Interface with Other Work: Communicate and coordinate with mechanical installer.
- B. Louver Units:
 - 1. Install according to manufacturer's approved Shop Drawings.
 - 2. Install plumb, level, in proper alignment with adjacent work.
 - 3. Form tight joints. Anchor firmly.

3.03 REPAIR/RESTORATION

- A. Touch up marred finishes but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

3.04 ADJUSTING AND PROTECTION

- A. Adjust units to operate in proper manner and easily without binding.
- B. Protect from corrosive or galvanic action by application of heavy coating of bituminous paint on surfaces in contact with concrete, masonry, or dissimilar metals.
- C. Protect from damage during remainder of construction period.

3.05 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.

- B. System:
 - 1. Clean exposed surfaces of louvers to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
 - 2. Before final inspection, clean exposed surfaces using materials and methods recommended by manufacturer.

DIVISION 9 - FINISHES

SECTION 09 29 00 - GYPSUM BOARD

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Interior gypsum drywall.
 - 2. Moisture resistant drywall.
 - 3. Corner beads and trim.
 - a. Metal.
 - b. Prefinished matching trim.
 - 4. Joint treatment.
 - 5. Drywall accessories including, but not limited to:
 - a. Access Panels
 - b. Fasteners.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry
 - 2. Section 07 21 00 - Thermal Insulation
 - 3. Section 09 30 00 - Tiling
 - 3. Section 09 91 00 - Painting

1.02 REFERENCES

- A. ANSI A108.11 - Installation of Cementitious Backer Board
- B. ASTM:
 - 1. C840 - Application and Finishing of Gypsum Board
 - 2. C1002 - Standard for Steel Self-Piercing Tapping Screws for Application of Gypsum Panels
 - 3. C1396 - Standard for Gypsum Board
 - 4. D3273 - Test for Resistance to Growth of Mold on the Surface of Interior Coatings
 - 5. E84 - Surface Burning Characteristics of Building Materials
 - 6. E119 - Fire Tests of Building Construction Materials
- C. Gypsum Association - Levels of Gypsum Board Finish (GA 214-Latest Edition)

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide drywall systems units made of components of standard construction furnished by one manufacturer as coordinated assemblies.
- B. Regulatory Requirements:
 - 1. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

1.05 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes.
- B. Stack panels flat to prevent sagging.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions:
 - 1. Joint Treatment: Control heating, ventilating during finishing operations to ensure maintenance of 55 degrees F minimum temperature.
 - 2. Comply with ASTM C840 or manufacturer's recommendations, whichever are more stringent.
 - 3. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.
- B. Do not install panels that are wet, show moisture damage, or are mold damaged.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Gypsum Drywall:
 - 1. Standard of Quality: Design is based on products of United States Gypsum Company (USG) www.usg.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with specified requirements are:
 - a. G-P Gypsum www.gp.com/gypsum
 - b. National Gypsum Company www.nationalgypsum.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

- B. Primer Surfacer: Subject to compliance with requirements, acceptable manufacturers are:
 - 1. USG, Tuff-Hide.
 - 2. Sherwin Williams, PrepRite High Build
 - 3. Manufacturer of comparable products meeting requirements of specifications.
- C. Corner Beads and Trim:
 - 1. Design is based on products of Dietrich Metal Framing, Pittsburgh, PA www.dietrichmetalframing.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with specified requirements are:
 - a. Sheetrock brand products of USG www.usg.com.
 - b. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Panels, General:
 - 1. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Interior Gypsum Drywall:
 - 1. Meet ASTM C1396.
 - 2. Standard Gypsum Board:
 - a. Thickness: 5/8-inch unless noted otherwise.
 - b. Facing: Paper faced.
 - c. Long edges tapered to receive standard joint treatment.
 - d. Use in wall and ceiling locations unless noted otherwise.
 - 3. Fire-rated Gypsum Board (GBX):
 - a. Thickness: 5/8-inch-thick.
 - b. Horizontal applications: Type C core.
 - c. Vertical applications: Type X core.
 - d. Facing: Paper faced.
 - e. Long edges tapered to receive standard joint treatment.
 - f. Use at fire rated walls and ceilings.
 - 4. Moisture Resistant Panels (GBMR):
 - a. Meet ASTM D3273 for moisture and mold resistance.
 - b. Core: 5/8 inch Type X, moisture and mildew resistant.
 - d. Long Edges: Tapered to receive standard joint treatment.
 - e. Product: Gold Bond XP as manufactured by National Gypsum Company.
 - f. Use in restroom ceilings.
- C. Metal Corner Beads and Trim:
 - 1. Fire rated.
 - 2. Paper faced.

3. Rust resistant.
 4. Corner Bead: USG Dur-A-Bead.
 5. Control Joint: USG 093.
 6. Flex Corner Bead: USG 800.
 7. "J" Bead: USG 200-A.
- D. Joint Tape:
1. Interior Gypsum Wallboard:
 - a. Paper tape.
 - b. Do not use in wet areas.
 - c. Recycled content paper.
 2. Glass-mat faced gypsum Board: Use tape recommended by gypsum board manufacturer.
- E. Joint Compound:
1. Interior Gypsum Panels: Ready-to-use joint compound (taping, topping, general purpose).
 2. Do not use all-purpose joint compound in wet areas.
 3. Verify formulation is compatible with other compounds applied on previous or for successive coats.
 4. Setting Type Mix:
 - a. Abuse resistant.
 - b. Non shrink.
 - c. Rapid setting.
 - d. Cement based.
 - e. Mold and moisture resistant.
 - f. Meets ASTM D3272 and 3274.
- F. Drywall Accessories:
1. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
 2. Thermal Insulation: See Section 07 21 00.
 3. Vapor Retarder: See Section 07 21 00.
 4. Access Panels:
 - a. Provide (3) drywall access panels.
 - b. 24 inches by 24 inches.
 - c. Product: Style "DW" manufactured by Milco, Inc., Nystrom (www.nystrom.com) or equal product of other manufacturers accepted in advance by architect.
 5. Fasteners:
 - a. Comply with ASTM C1002.
 - b. Fasteners: Screws, clips, fasteners specifically designed for application of gypsum drywall panels.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades:
 - 1. Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
 - 2. Examine areas and substrates, with installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Verification of Conditions: Verify that gypsum drywall may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Examine panels before installation. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications of damage include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications of mold damage include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- D. Discrepancies: Do not proceed with installation in areas of discrepancy until fully resolved.

3.02 PREPARATION

- A. Protection: Protect installed work and materials of other trades.

3.03 INSTALLATION

- A. Gypsum Drywall:
 - 1. Comply with ASTM C840.
 - 2. Lay out panels to minimize waste; reuse cutoffs whenever feasible.
 - 3. Use full-length boards where possible.
 - 4. Install with true, even surfaces, straight sharp corners, face out.
 - 5. Do not force into place.
 - 6. In general, install gypsum board on ceilings before walls.
 - 7. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling.
 - 8. Install flat panels plumb, level, with vertical joints on bearing.
 - 9. Loosely butt joints to be taped; firmly butt joints to be left untreated.
 - 10. Stagger end joints, joints between panels to achieve maximum of bridging, minimum of continued joints.
 - 11. Stagger vertical joints on opposite sides of partitions.
 - 12. Do not make joints other than control joints at corners of framed openings.
 - 13. Form control and expansion joints with space between edges of adjoining gypsum panels, where indicated on Drawings or, if not indicated, no more than 30 feet on center.

14. Attachment:
 - a. Screw to framing.
 - b. For walls with gypsum board applied vertically, space screws 8 inches on center along edges, 12 inches on center.
 - c. For walls with gypsum board applied horizontally and ceiling construction, space screws 12 inches on center.
 - d. Space screws according to rated design for fire-resistive partitions, ceilings.
 - e. Fasten gypsum board beginning at center, work towards outer edges. Hold board firmly against supports while fastening.
 - f. Locate fasteners opposite each other on adjacent ends and edges; locate at edges of boards 3/8 inch to 1/2 inch from edge.
15. Sealing:
 - a. Seal around pipes, ducts, conduit, other items extending through gypsum board partitions or ceilings.
 - b. Seal backs, sides of electrical boxes.
 - c. Seal joints, cut edges, nail and screw heads, punctures in water-resistant gypsum backing board with waterproofing sealant recommended by gypsum board manufacturer.

B. Trim:

1. Drawings are not intended to show all trim required. Carefully inspect Drawings and verify precise locations, types of trim to be used.
2. Installation:
 - a. Follow manufacturer's installation instructions to validate lifetime warranty and replacement costs.
 - b. Install corner reinforcing at external corners, install J-bead casing trim where gypsum board abuts other materials.
 - c. Control joints:
 - 1) Comply with ASTM C840.
 - 2) Install where indicated on Drawings, if not indicated install in the following locations:
 - a) Where not indicated, locate in walls, partitions not over 30 feet on center.
 - b) Locate above door frames where possible; construct one control joint above each jamb of door.
 - d. Install trim plumb, level, true to line, with firm attachment to supporting members.

- C. Access Panels: Install in ceilings, soffits, walls where indicated and in strict accordance with manufacturer's recommendations.

3.04 TAPING AND FINISHING

A. General:

1. 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.

2. Promptly remove residual joint compound from adjacent surfaces.
3. Prefill open joints, rounded or beveled edges, and damaged surface areas.
4. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

B. Finish:

1. Tool joints as smoothly as possible to minimize sanding and dust.
2. Protect workers, building occupants, and HVAC systems from gypsum dust.
3. Level 4 finish, as specified by GA-214-90.

3.05 CLEANING AND PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
- C. Do not allow accumulation of scraps and debris arising from Work of this Section.
- D. Maintain premises in neat, orderly condition.

In event of spilling or splashing compound or finish material onto other surfaces, immediately remove spilled or splashed material and all trace of residue.

SECTION 09 30 00 - TILING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide
 1. Interior Tile:
 - 1) Porcelain Wall Tile.
 2. Tile accessories, including but not limited to:
 - a. Matching trim units.
 3. Setting materials.
 4. Grouting materials.
- B. Related Sections:
 1. Section 04 20 00 – Unit Masonry Assemblies

1.02 REFERENCES

- A. ANSI:
 1. A108 / A118 / A136.1 – Specifications for the Installation of Ceramic Tile
 2. A137.1 – Specifications for Ceramic Tile

- B. TCA - Handbook for Ceramic Tile Installation

1.03 DEFINITIONS

- A. Module Size: Actual tile size plus joint width.

1.04 SUBMITTALS

- A. Provide submittals according to Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Samples:
 - 1. Initial Selection: Samples of colors specified herein. Include samples of grout involving color selection.
- D. Shop Drawings: Shop Drawings indicating tile patterns and locations and widths of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
 - 1. Locate precisely each joint and crack in tile substrates by measuring, record measurements on Shop Drawings, and coordinate them with tile joint locations, in consultation with architect.
- E. Qualification Data: Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of architects and owners, plus other information specified.

1.05 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Tile: Provide from a single source, or the same production run, of consistent quality in appearance and physical properties for each contiguous area.
 - 2. Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of tile.
 - 2. Contractor: 3 years experience in the installation of tile.
- C. Codes and Standards:
 - 1. Comply with pertinent codes and regulations.
 - 2. Comply with ANSI A137.1.
 - 3. Comply with requirements of indoor air quality (IAQ) limits for indoor air pollutants.
 - 4. Comply with ADA slip coefficient of friction.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Venting: Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
 - 2. Temperature: Maintain temperatures at 50 degrees F (10 degrees C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.
- B. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 WARRANTY

- A. Subcontractor to warrant installation for one year from date of Substantial Completion.

1.08 MAINTENANCE

- A. Extra Materials:
 - 1. Provide for maintenance purposes, quantity equal to 3 percent of each type of material installed.
 - 2. Furnish from same production run as materials installed.
 - 3. Package and mark to identify building, material type, and color.
 - 4. Deliver and store where directed by owner.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Porcelain Wall Tile:
 - 1. Standard of Quality: Design is based on products of American Olean, unless otherwise noted. www.americanolean.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Crossville Tile www.crossvilleinc.com
 - b. Daltile www.daltile.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

2.02 PRODUCTS

- A. General: Furnish tile complying with ANSI "Standard Grade" requirements unless otherwise indicated.
- B. Factory Blending: For tile exhibiting color variations within ranges selected, blend tile in each package to show same range and colors.

2.03 TILE PRODUCTS

- A. Porcelain Wall Tile:
 - 1. Tile Type "T":
 - a. Type: Colorbody Porecelain
 - b. Field Tile Size: 12 inch by 24 inch nominal.
 - c. Thickness: 3/8 inch.
 - d. Texture: Unpolished.
 - e. Grout Width: 3/16" or as recommended by manufacturer.
 - f. Product: Method as manufactured by American Olean.
 - g. Color: MT05 Khaki
- B. Tile Accessories:
 - 1. Matching Base and Trim Units:
 - a. Base:
 - 1) Coved with surface bullnose edge.
 - 2) Size: 6 inch by 12 inch nominal.
 - b. Wainscot cap:
 - 1) Surface bullnose.
 - 2) Size: 3 inch by 12 inch nominal.
- C. Setting Materials:
 - 1. Standard thin-set mortar.
 - 2. Epoxy.
 - 3. Provide setting materials as recommended by manufacturer. Notify architect of discrepancies in writing prior to installation.
- D. Grouting Materials:
 - 1. Sanded cement grout, ANSI A108.10.
 - 2. Epoxy grout, ANSI A118.3.
 - 3. Provide grouting materials as recommended by manufacturer. Notify architect of discrepancies in writing prior to installation.

2.04 MIXING MORTARS AND GROUT

- A. Mix to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions. Do not dilute latex additive.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with
- D. Latex-Portland Cement Mortar:
 - 1. Provide either job mixed Portland cement-sand mortar mixed with latex additive, or prepared dry set Portland cement mortar mixed with latex additive or pre-packaged Portland cement dry mortar mix containing dry, redisturbable polymer additive to which only water may be added at Site.

2. Job mixed mortar to be one part Portland cement to one part fine sand.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing Work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Examine substrates, areas, and conditions where tile will be installed, with installer present. Verify that Work may commence according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved.

3.02 PREPARATION

- A. Protection: Protect installed Work and materials of other trades.
- B. Field-Applied Surface Preparation: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.
- C. Fill cracks, holes, and depressions with trowelable leveling and patching compound, according to tile-setting material manufacturer's written instructions.

3.03 INSTALLATION OF TILE

- A. Comply with ANSI A108 Series "Specifications for Installation of Ceramic Tile."
- B. Exterior or Interior Concrete or Masonry: Install according to TCA Method: W202.
- C. Grout Joints:
 1. Provide soft joints at vertical inside corners and cove base tile to floor tile. Grout at these joints is prohibited.
 2. At restrooms, use the movement and control joint profile to meet the hygienic requirements of commercial restrooms.
- D. Control Joints:
 1. Perimeter of floor plane next to the wall.
 2. Wall: 12 feet on center maximum.

3.04 GROUTING

- A. Preparation: Soak or dampen joints of tile to be grouted with Portland cement grout. Soak or dampen other joints as recommended by grout manufacturer. If epoxy grout to be used, follow manufacturer's joint preparation instruction.

- B. Porcelain Stoneware Tile: Grout same day that tile is set.
- C. Tile Set with Organic Adhesives: Use latex-mixed grout.
- D. Joints: Force grout into tile joints completely filling with compacted grout and covering mortar. Finish joints of square-edged tile flush with surface. Strike or tool joints of cushion-edged tile to depth of cushion. Fill gaps and skips, and retool.
- E. Curing: Damp cure Portland cement mortar bed installations, latex-Portland cement thin-set installations and grouts containing Portland cement for minimum 72 hours. Cure epoxy grouts minimum 48 hours.

3.05 SEALING

- A. Seal all cement grout joints with silicone sealer after grout has cured 28 days.
 - 1. Use adequate ventilation.
 - 2. Cloth used with this product is combustible and should be discarded in closed, metal containers outside the building.
 - 3. Clean surface thoroughly. Dry and cure prior to application.
 - 4. Maintain surface temperature between 50 degrees to 80 degrees.
 - 5. Use full strength. Apply with paint brush, cloth, or grout seal applicator.
 - 6. Remove any excess sealer from tile surfaces immediately with a soft, dry cloth.
- B. Epoxy grouts do not require a sealing.

3.06 REPAIR/RESTORATION

- A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials and procedures recommended or furnished by manufacturer.

3.07 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from Work of this Section. Maintain premises in neat, orderly condition.
- B. System:
 - 1. Clean exposed surfaces of tile using materials and methods recommended by manufacturer.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation.
 - 3. Protect metal surfaces and plumbing fixtures from effects of cleaning.
 - 4. Flush surfaces with clean water before and after cleaning.
 - 5. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

3.08 DEMONSTRATION

- A. Maintenance Instructions: Manufacturer's representative to schedule and attend meeting with owner's representatives to explain:
 - 1. Maintenance and care instructions.
 - 2. Recommended maintenance program.
 - 3. Warranty requirements.

3.09 PROTECTION

- A. Prohibit foot and wheeled traffic from using newly tiled floor for at least 3 days.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Protect installed tile work with draft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide exposed ceiling suspension system:
 - 1. Acoustical ceiling panels.
 - 2. Metal suspension system.
 - 3. Accessories for installation of complete system.
- B. Related Sections:
 - 1. Section 04 20 00 – Unit Masonry Assemblies
 - 2. Section 06 10 00 – Rough Carpentry
 - 3. Section 06 17 53 – Shop-Fabricated Wood Trusses
 - 3. Section 09 29 00 – Gypsum Board

1.02 REFERENCES

- A. ASTM:
 - 1. A641 - Zinc-Coated Carbon Steel Wire
 - 2. B164 - Nickel-Copper Alloy Rod, Bar, Wire
 - 3. C635 and C636 - Manufacture of Metal Suspension Systems and Installation of Suspended Ceilings
 - 4. E84 - Surface Burning Characteristics of Building Materials

5. E119 - Fire Tests of Building Construction and Materials
6. E1477 - Luminous Reflectance Factor of Acoustical Materials

B. CISCA Ceiling Systems Installation Handbook

1.03 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

1.04 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data:
1. Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
 2. Provide a cut sheet or material safety data sheet for every sealant used within the building with VOC levels highlighted.
- C. Shop Drawings:
1. Show system fabrication, installation drawings, including plans, elevations, section details of components, joint locations and configurations within system and between system and adjoining system.
 2. Show ceiling-mounted items including lighting fixtures, diffusers, grilles, access panels, and special moldings.
- D. Samples:
1. Color samples: Submit manufacturer's standard color samples with Product Data and Shop Drawings.
 2. Product samples: One 6 inch by 6 inch sample of each type of acoustical ceiling tile.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Provide acoustical ceiling panel system units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Regulatory Requirements: Comply with pertinent codes and regulations, and recommendations published by the ceiling and interior systems contracting associations.

1.06 COORDINATION

- A. Coordinate layout and installation with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store and handle materials according to manufacturer's recommendations.

1.08 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.09 WARRANTY

- A. Grid System: Manufacturer's warranty on rusting and manufacturing defects: 10 year limited warranty.
- B. Acoustical panels: Manufacturer's warranty
 - 1. Sagging 30 year limited warranty.
 - 2. Mold/Mildew and Bacterial Growth: 30 year limited warranty.

1.10 MAINTENANCE

- A. Extra Materials: Provide for maintenance purposes, quantity equal to 2 percent of each type of material installed. Package and mark to identify building and material type and color. Store as directed after completion of work.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Acoustical Ceiling Panels:
 - 1. Standard of Quality: Design is based on products of Armstrong Architectural Products. www.armstrong.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. USG Interiors, Inc., Chicago, IL www.usg.com
 - b. Certainteed www.certainteed.com
 - c. Manufacturer of comparable products meeting requirements of specifications.
- B. Metal Suspension Systems:
 - 1. Standard of Quality: Design is based on products of Armstrong Architectural Products, www.armstrong.com

2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. DONN Suspension Systems by USG, www.usg.com
 - b. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Acoustical Ceiling Panels (ACT-1):
 1. Meet or exceed requirements of ASTM E1264.
 2. Types:
 - a. Type IV: Wet Formed Mineral Fiber base with acoustically transparent membrane-faced overlay.
 3. Edge detail:
 - a. Beveled.
 4. Size: 24 inches by 24 inches.
 5. Thickness: 3/4-inch.
 6. Fire Rating: Nonrated.
 7. Surface Burning Characteristics (ASTM E84): Class A (Flame Spread 25 or under).
 8. Light Reflectance: 0.90 (ASTM E1477).
 9. Noise reduction coefficient (NRC): 0.70
 10. Anti-mold/mildew and bacteria.
 11. Color: White.
 12. Product: Ultima 15/16 inch Beveled Tegal as manufactured by Armstrong.
- B. Metal Suspension Systems:
 1. Prelude as manufactured by Armstrong. System to comply with applicable ASTM C635 requirements.
 - a. Non-fire-resistance-rated.
 - b. Direct-hung.
 - c. Intermediate -duty system
 - d. Color:
 - 1) White at ACT-1.
 - e. Face Dimension: 15/16-inch.
 2. Trim:
 - a. Provide commercial quality trim materials at ACT-1 as required for proper installation of ceiling and grid. Factory finish trim to match ceiling grid.
- C. Accessories:
 1. Attachment Devices:
 - a. Sized for 5 times design load indicated in ASTM C635, Table 1, Direct Hung.

- 2. Hanger Wire:
 - a. Galvanized carbon steel wire, ASTM A641, soft temper, prestretched, Class 1 coating, sized so stress at 3 times hanger design load (ASTM C635, Table 1, Direct Hung), will be less than yield stress of wire; provide not less than 12 gage.
 - b. Corrosion Protection: Nickel-copper alloy wire; ASTM B164 nickel copper alloy UNS N04400 at locations indicated.
 - 3. Edge Moldings, Trim: Metal of types and profiles indicated or, if not indicated, manufacturer's standard molding for edges, penetrations of ceiling which fits with type of edge detail, suspension system indicated.
 - a. For lay-in panels with reveal edge details: Stepped edge molding which forms reveal of same depth, width as formed between edge of panel and flange at exposed suspension member, unless indicated otherwise.
- D. Other Materials: Other materials not specifically described but required for complete, proper installation of acoustical ceiling panel system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing, to which acoustical tile ceilings attach or abut, with installer present, for compliance with requirements specified that affect ceiling installation and anchorage, and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
- B. Field Dimensions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of work. Field verify dimensions and assume full responsibility for their accuracy.
- C. Verification of Conditions: Verify that acoustical ceiling panel system may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- D. Discrepancies:
 - 1. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 2. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection:
 - 1. Protect installed work and materials of other trades.
 - 2. Light fixtures and other recessed equipment within all ceiling areas to be protected as required.

3.03 INSTALLATION

- A. Comply with ASTM C636 and manufacturer's instructions.
- B. Acoustical Panels:
 - 1. All 4 edges of each board to be in firm contact with and supported by flanges of the runner sections.
 - 2. Check level of system during installation; maintain level and true plane.
 - 3. Lay out to minimize waste. Reuse cutoffs whenever feasible.
- C. Metal Suspension Systems:
 - 1. Pattern:
 - a. Lay out according to reflected ceiling plans.
 - b. Where not otherwise indicated, lay out so margins on opposite sides of rooms are equal and greater than 1/2 tile wide.
 - 2. Main Runners:
 - a. Suspend with not less than 12 gage galvanized, soft annealed steel wire.
 - b. Securely attach hanger wires to structure above.
 - c. Hang wires vertically with no kinks or bends.
 - d. Remove and replace dented, bent, or kinked members.
 - e. Space hangers along main runners according to manufacturer's recommendations and code requirements.
 - 3. Reinforcement: Reinforce suspension system as necessary to adequately support suspension system, acoustical material, light fixtures, grilles, registers, other mechanical equipment to be supported by system with maximum hanger spacing 4 feet on center.
 - 4. Supports:
 - a. Do not support from electrical conduit, mechanical ducts, pipes, or equipment.
 - b. Where spans exceed recommended or specified spans, furnish larger main runner channels or additional reinforcing members, hangers, stiffening, or bracing as necessary to support loads without exceeding specified allowable deflection.
 - c. Swing hangers are not permitted.
 - 5. Edge Moldings: Install at walls and vertical projections through ceiling.

3.04 CLEANING

- A. Following installation, clean dirt, finger marks, and other discolored spots from exposed surfaces in manner and with materials recommended by manufacturer.
- B. Replace dirty, discolored, damaged, and improperly applied units.

SECTION 09 65 19 - RESILIENT TILE FLOORING AND BASE

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Resilient tile:
 - a. Vinyl composition tile.
 - 2. Resilient base:
 - a. Coved vinyl base.
 - 3. Accessories including, but not limited to:
 - a. Adhesives.
 - b. Latex underlayment.
 - c. Transition molding.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete
 - 2. Section 03 35 22 – Mechanically Polished Concrete Floor Finish
 - 3. Section 04 20 00 – Unit Masonry Assemblies
 - 4. Section 09 29 00 – Gypsum Board
 - 5. Section 09 30 00 - Tiling
 - 6. Section 09 67 00 - Fluid Applied Flooring

1.02 REFERENCES

- A. Armstrong Technical Manuals
 - 1. Armstrong Guaranteed Installation Systems manual, F-5061
- B. ASTM:
 - 1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - 3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 4. ASTM F 1066 Standard Specification for Vinyl Composition Tile
 - 5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
 - 6. ASTM F 1861 Standard Specification for Resilient Wall Base
 - 7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

- C. 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 Standard Test Method for Measuring the Smoke Generated by Solid Materials

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings: Submit Shop Drawings showing system fabrication, installation drawings, including plans, elevations, sections details of components, joint locations and configurations within system and between system and adjoining system.
- D. Submit results of slab moisture testing prior to tile installation.
- E. Samples:
 - 1. Initial Selection: Submit manufacturer's standard color samples for each type of finish with Product Data and Shop Drawings.
 - 2. Verification: Prior to shipping, submit each type of product indicated; in sets for each color, texture, and pattern specified, showing a full range of variations expected in these characteristics.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: General: Provide resilient tile flooring and base units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of resilient tile flooring and base.
 - 2. Contractor: 3 years experience in the installation of resilient tile flooring and base.
 - 3. Personnel: For actual installation of resilient tile flooring and base, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

- C. Regulatory Requirements:
 - 1. Meet current standards of ADA.
 - 2. Fire Performance
 - a. Fire Performance Characteristics: Provide resilient vinyl composition tile flooring with the following fire performance characteristics as determined by testing material according to ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
 - b. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
 - c. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
- D. Field Samples: Furnish sample of each type of resilient tile flooring and base for review prior to manufacture/installation.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store in dry space, protected from weather, at temperatures between 50 degrees and 90 degrees F.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Maintain temperature of spaces to receive resilient flooring as recommended by manufacturer prior to, during and after installation.
- B. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 WARRANTY

- A. Replacement or repair to architect's satisfaction for materials and labor for a period of 5 years from Final Completion.

1.08 MAINTENANCE

- A. Extra Materials: Provide for maintenance purposes, quantity equal to 5 percent of each type, of material installed. Package and mark to identify building and material type and color. Deliver and store where directed by owner.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Vinyl Composition Tile:

1. Standard of Quality: Design is based on products of Armstrong World Industries, Lancaster, PA
2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Mannington, Salem, NJ www.mannington.com
 - b. Roppe Corporation, Fostoria, OH www.roppe.com
 - c. Tarkett Inc., Parsippany, NJ www.tarkett.com
 - d. Manufacturer of comparable products meeting requirements of specifications.

B. Vinyl Base:

1. Standard of Quality: Design is based on products of Johnsonite (Tarkett), Chagrin Falls, OH www.johnsonite.com
2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Armstrong World Industries, Lancaster, PA www.armstrong.com
 - b. Mannington, Salem, NJ www.mannington.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

A. Vinyl Composition Tile:

1. Tile (VCT-1):
 - a. Size: 12 inches by 12 inches by 1/8 inch.
 - b. ASTM F1066.
 - 1) Class 2 - Through pattern.
 - c. Slip resistant.
 - d. Product: Imperial Texture Classics by Armstrong.
 - 1) Color/Pattern: Pewter 51908.

B. Wall Base:

1. Vinyl, thermoplastic.
2. 1/8 inch thick base.
3. Comply with ASTM F1861.
4. Style:
 - a. Coved base.
5. Surface: Smooth.
6. Height: 6inches.
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.
9. Color: 48 Grey WG by Johnsonite.

- C. Accessories:
1. Reducer Strips:
 - a. Use between resilient flooring and exposed concrete floors.
 - b. 1 1/2 inch (minimum) wide beveled rubber or vinyl strips suitable for use with 1/8 inch thick tile or other types.
 2. Edge Strips:
 - a. Metal: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.
 3. Latex Underlayment: As recommended by resilient flooring manufacturer.
 4. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.
 5. Adhesives for Tile and Base:
 - a. As recommended by manufacturer for each specific material, location, use.
 - b. Water-resistant.
 - c. Comply with following VOC limits:
 - 1) VCT and asphalt tile adhesives: 50 g/L.
 - 2) Cove base adhesives: 50 g/L.
 - 3) Rubber floor adhesives: 60 g/L.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
- B. Verification of Conditions:
1. Verify that resilient tile flooring and base may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
 2. Verify substrate is dry and free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion.
- C. Discrepancies: Immediately notify E/A. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protect installed work and materials of other trades.
- B. Install after other finishing operations, including painting, are completed.

C. Surface Preparation:

1. Concrete: Test for excessive moisture content according to ASTM F710 and tile manufacturer's instructions before starting work. Do not proceed with installation until test results meet minimum requirements of manufacturer.
 - a. Alkalinity and adhesion testing.
 - b. Anhydrous calcium chloride test, ASTM F1869.
 - c. pH greater than 9 must be neutralized prior to beginning installation.
 - d. Other tests recommended by manufacturer.
 - e. Submit moisture test results to architect prior to beginning flooring installation.
2. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates
3. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone; using mechanical methods recommended by manufacturer. Do not use solvents.
4. Prime concrete according to adhesive manufacturer's recommendations.
5. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.
6. Proceed only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Tile:

1. Use material from same factory batch or color run in each area or room.
2. Install in strict accordance with manufacturer's instructions.
3. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width.
4. Minimize waste.
5. Lay tiles square with room axis.
6. Match tiles for color and pattern by selecting tiles from cartons in sequence recommended by manufacturer.
7. Install with smooth side up (if pre-sanded).
8. Lay tile with grain running in one direction.
9. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
10. Do not force or compress tile.
11. Extend tiles into toe spaces, door reveals, closets, and similar openings.
12. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
13. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
14. Cut neatly at walls and partitions so that flooring joint will be covered by base.
15. Extend neatly into feature strips and edging strips as indicated on Drawings.

16. Expansion joints in concrete substrate: Use expansion joint covers designed for resilient floor coverings.
 17. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
 18. Completed installation to be firmly adhered, and have smooth, even finished surface.
 19. Do not use excessive adhesive and remove surplus adhesive from finished surfaces immediately.
- B. Strips:
1. Install reducer strips where resilient tile meets exposed concrete floors or other floor finishes of different surface elevation.
 2. Install 1-inch-wide feature strips under door center line where resilient flooring of different colors occurs in rooms on both sides of door or where vinyl composition tile abuts access flooring.
- C. Joints: Carefully cut and fit floor pattern inlays to produce true even joints similar to those between tiles, to patterns indicated on Drawings.
- D. Finishing:
1. Do not start finish process for minimum 3 days after installation.
 2. Seal flooring materials with clear, water-based, low-VOC sealant as recommended by manufacturer.
 3. After vinyl composition tiles are thoroughly set and cleaned, give floors two coats of water emulsion wax with 12 percent carnauba wax solids content. Machine buff each coat.
- E. Base:
1. Use base from same factory color run in each room.
 2. Install with tight butt joints, with top and bottom edges in firm contact with walls and floor.
 3. Install base as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 4. Install base on free standing columns, fixed casework and fixed equipment.
 5. Do not stretch base during installation.
 6. On masonry surfaces or other irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
 7. Job-formed corners:
 - a. Outside:
 - 1) Use straight pieces of maximum lengths possible.
 - 2) Form without producing discoloration (whitening) at bends.
 - 3) Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

- b. Inside:
 - 1) Use straight pieces of maximum lengths possible.
 - 2) Form by cutting an inverted V shaped notch in toe of wall base at the point where corner is formed.
 - 3) Shave back of base where necessary to product a snug fit to substrate.

3.04 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.
- B. Resilient Tile Flooring and Base:
 - 1. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance.
 - 2. Thoroughly clean resilient flooring and base after installation to remove excess adhesive, dirt, and other foreign substances.
 - 3. Damp-mop surfaces to remove marks and soil after time period recommended by manufacturer.
 - 4. Use materials, procedures recommended or furnished by manufacturer.

3.05 PROTECTION

- A. Close space to traffic for 48 hours after floor covering installation.
- B. Protect from mars, marks, indentations, and other damage from construction operations during remainder of construction period.
- C. Use protection methods recommended in writing by manufacturer.

3.06 DEMONSTRATION

- A. Maintenance Instructions: Manufacturer's representative to schedule and attend meeting with owner's representatives to explain:
 - 1. Maintenance and Care Instructions.
 - 2. Recommended Maintenance Program.
 - 3. Warranty Requirements.

SECTION 09 67 00 - FLUID APPLIED FLOORING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Concrete sealer/hardener.
 - 2. Waterproof membrane including coved base.

- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete
 - 2. Section 03 35 22 – Mechanically Polished Concrete

1.02 REFERENCES

- A. ASTM:
 - 1. D3450 - Washability Properties of Interior Architectural Coatings
 - 2. D3960 - Determining VOC Content of Paints and Coatings
- B. SSPC-SP 13 - Surface Preparation of Concrete

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Provide a cut sheet or material safety data sheet for every sealant used within the building with VOC levels highlighted.
 - 5. Operation and maintenance data.
- C. Maintenance Manual: Provide to owner maintenance and warranty data in "Maintenance Manual" at Maintenance Demonstration at Substantial Completion.

1.04 QUALITY ASSURANCE

- A. Provide special flooring, including primers, colorants, slip-retardant aggregates, resins, hardening agents, and finish coats from a single manufacturer.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of specified flooring.
 - 2. Contractor: 3 years experience in the installation of specified flooring.
 - 3. Personnel: For actual installation of special flooring, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.
- C. Regulatory Requirements:
 - 1. Meet or outperform VOC limits for adhesives, sealants.
 - 2. Products shall comply with the United States Clean Air Act for maximum VOC content.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle materials according to manufacturer's written instructions.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Refer to manufacturer's instructions; strictly follow.
- B. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.
- C. Lighting: Permanent lighting will be in place and working before installation of floor coating.
- D. Dust and Contaminants:
 - 1. Schedule coating work to avoid excessive dust and airborne contaminants.
 - 2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

1.07 WARRANTY

- A. Manufacturer shall warranty the installation of the product.
 - 1. Warranty shall include warranty against delamination, adhesion defects, or deterioration due to normal wear, not including owner neglect.
 - 2. Concrete Sealer/Hardener: Warranty shall be in effect for a period of 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Concrete Sealer/Hardener:
 - 1. Standard of Quality: Design is based on Seal Hard of L&M Construction Chemicals, Inc., Omaha, NE www.lmcc.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. Ashford Formula by Curecrete Chemical www.ashfordformula.com
 - b. Day-Chem Sure Hard J-17 by Dayton Superior Chemical and Cement Products, Kansas City, KS www.daytonsuperiorchemical.com
 - c. Federal Formula by Valspar Corporation www.valspar.com
 - d. Liquid Hard by W.R. Meadows www.wrmeadows.com
 - e. Manufacturer of comparable products meeting requirements of specifications.
- B. Waterproof Membrane/Wearing Surface including Coved Base:

Standard of Quality: Design is based on 3552 *Epo-Flex* by General Polymers www.generalpolymers.com, Decoflake 6000 by Sika Flooring

 - 1. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - a. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Concrete Sealer/Hardener:
 - 1. Chemically reactive, waterborne, silicate blend.
 - 2. Odorless, colorless, VOC compliant.
 - 3. Penetrates, hardens, and densifies concrete surfaces.
 - 4. Noncombustible.
 - 5. Non-staining.
- B. Waterproof Membrane Surface including Coved Base:
 - 1. System shall consist of primer/binder, epoxy coating waterproofing membrane, wear course, and seal coat.
 - 2. Properties:
 - a. Flexible, elastomeric membrane with ability to bridge cracks, waterproof, and will accept heavy traffic.
 - b. Tensile strength (ASTM D412): 1700 psi.
 - c. Tensile elongation (ASTM D412): 80 percent.
 - d. Adhesion: ACI 503R: 350 psi.
 - e. Water absorption (ASTM D570): 2.6 percent.
 - f. Thermal cycling (ASTM C884): 24 hours - 21 degrees C to 25 degrees C: No cracking.
 - g. Flammability: Self extinguishing over concrete.
 - h. Abrasion resistance (ASTM D4060, 1000 cycles): 100 mg lost.
 - i. VOC: 0.
 - 3. Color: Color chosen by architect from manufacturer's standard colors.
- B. Special Flooring Accessories: Other materials not specifically described but required for complete, proper installation subject to acceptance of architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that special flooring may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Verify with concrete contractor that neither curing compound nor sealer was used on slab. Ensure concrete substrate has cured a minimum of 30 days.
- D. Discrepancies:
 - 1. Immediately notify architect.
 - 2. Do not proceed with installation in areas of discrepancy until fully resolved.
 - 3. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection: Protect installed work and materials of other trades.
- B. Surface Preparation:
 - 1. Prepare concrete surfaces according to manufacturer's instructions, SSPC-SP 13 and ICRI 03732.
 - 2. Provide concrete testing required by coating manufacturer.
 - 3. Surface should be checked for soundness and any "hollow" area should be removed.
 - 4. Fill depressions and spalled areas and cracks with manufacturers approved product.
 - 5. Grind or otherwise make smooth.
 - 6. Remove grease, oil, and other penetrating contaminants.
 - 7. Repair damaged and deteriorated concrete to acceptable condition, leaving surface free of dust, dirt, laitance, and efflorescence.
 - 8. Substrate for special flooring shall be prepared using manufacturer's recommended methods.

3.03 APPLICATION

- A. Coordinate with section 03 35 22 for sealant at polished concrete floors.
- B. Comply with design and manufacturer's recommendations, as accepted by architect.
- C. Sealer/Hardener:
 - 1. Allow concrete to cure minimum 3 days before application.
 - 2. Apply according to manufacturer's directions.
 - 3. Coats: 1-coat.
 - 4. Do not allow to dry before flushing excess with water from adjacent surfaces.
 - 5. Cure according to manufacturer's directions.
 - 6. Prevent contamination during application stages and before completing curing process.
 - 7. Close application area for minimum 24 hours.
- D. Waterproofing Membranes:
 - 1. Seal joints and cracks and prepare according to manufacturer's directions.
 - 2. Provide ambient air temperature of 60 degrees F.
 - 3. Cove Base:
 - a. Apply cove base mix to wall surfaces at locations shown to form cove base height of 4 inches, unless otherwise indicated.
 - b. Follow manufacturer's printed instructions including taping, mixing, priming, troweling, sanding, and top-coating of cove base.

3.04 REPAIR/RESTORATION

- A. Damaged Coatings: Touch up or repair. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- B. Use materials, procedures recommended or furnished by manufacturer.

3.05 CLEANING

- A. Site:
 - 1. Do not allow accumulation of scraps, debris arising from work of this Section.
 - 2. Maintain premises in neat, orderly condition.
 - 3. Safe and proper disposal of excess materials shall be done according to applicable federal, state, and local codes.
- B. System:
 - 1. Clean exposed surfaces of special flooring using materials and methods recommended by manufacturer.
 - 2. Remove temporary coverings and protection of surrounding areas and surfaces.

3.06 FIELD QUALITY CONTROL

- A. Manufacturer's Services: Provide technical assistance and guidance for surface preparation and application of coating systems.

3.07 DEMONSTRATION

- A. Maintenance Instructions: Manufacturer's representative to schedule and attend meeting with owner's representatives to explain:
 - 1. Maintenance and Care Instructions.
 - 2. Recommended Maintenance Program.
 - 3. Warranty Requirements.

3.08 PROTECTION

- A. Protect surfaces of coating systems from damage during construction until acceptance by owner at Substantial Completion.

SECTION 09 91 00 - PAINTING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Paint:
 - a. Exterior Substrates:
 - 1) Metal.
 - b. Interior Substrates:
 - 1) Concrete masonry units.
 - 2) Gypsum drywall.
 - 3) Ferrous and zinc-coated metal.
 - 4) Exposed structural steel.
- B. Perform the following:
 - 1. Surface preparation, priming, and finish coats for exposed surfaces and items including bare and primed mechanical and electrical equipment as scheduled or considered standard practice.
 - 2. In remodeled areas, paint items or areas indicated on the Drawings.
- C. Do not paint the following:
 - 1. Prefinished items, except as noted.
 - 2. Concealed spaces, except as noted.
 - 3. Labels:
 - a. Code requirements such as UL, FM.
 - b. Equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections:
 - 1. Section 04 20 00 - Unit Masonry Assemblies
 - 2. Section 05 12 00 - Structural Steel Framing
 - 3. Section 05 50 00 - Metal Fabrications
 - 4. Section 08 11 13 - Hollow Metal Doors and Frames (Commercial)
 - 5. Section 09 29 00 - Gypsum Board

1.02 REFERENCES

- A. ASTM:
 - 1. D16 - Standard Definitions of Terms
 - 2. D3450 - Washability of Interior Architectural Coatings
- B. Master Painters Institute (MPI): www.paintinfo.com
 - 1. Evaluation of Exterior Systems
 - 2. Evaluation of Interior Systems
 - 3. Surface Preparation

- C. Painting and Decorating Contractors of America (PDCA) P5 - Sample Procedures for Paint and Other Decorative Coating Systems
- D. Society for Protective Coatings (SSPC):
 - 1. SP 1 - Solvent Cleaning
 - 2. SP 13 - Surface Preparation of Concrete

1.03 DEFINITIONS

- A. DFT: Dry Film Thickness
- B. Minimum VS: Minimum Volume Solids
- C. Paint: Any “decorative, protective, or otherwise functional coating applied to a substrate. This substrate may be another coat of paint.” The Paint Handbook, by Guy E. Weismantel.
- D. Sheen: Standard coating terms defined in ASTM D16 apply.
- E. VOC: Volatile Organic Compound

1.04 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data:
 - 1. Submit manufacturer’s current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
 - 2. Provide schedule detailing the following:
 - a. Specific products to be used for each coat, identified by manufacturer’s catalog number and general classification.
 - b. Documentation that manufacturer has reviewed and approved each painting system.
 - c. Cross reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - d. Data pages for all products listed. Highlight the following:
 - 1) Type of resin.
 - 2) Dry film thickness.
 - 3) Volume solids.
 - 4) Units of sheen.
 - 5) VOC levels and MSDS.
 - 6) Other performance or descriptive data specified.

- C. Samples:
1. Color Selection:
 - a. Submit manufacturer's standard color drawdowns with Product Data for initial selection.
 - b. Label each card with:
 - 1) Job name.
 - 2) Date.
 - 3) Product name and number.
 - 4) Color number stated in color schedule.
 - 5) Name, address, phone number of supplying company.
 2. Color and Texture Verification Samples:
 - a. Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
 - b. "Step" each separate coat, including blockfillers and primers.
 - c. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- B. Qualifications:
1. Manufacturer: 5 years' experience in the manufacture of coating systems.
 2. Applicator: 3 years' experience in commercial application of coating systems.
- C. Regulatory Requirements:
1. Paint, stain, and wood preservative finishes and related materials are regarded as hazardous products and are subject to regulations for disposal.
 2. Products shall comply with the United States Clean Air Act for maximum VOC content.
 3. Clear wood finishes, floor coatings, stains, sealers, and shellacs applied to interior elements must meet the VOC content limits established in South Coast Air Quality management District, Rule 1113 for Architectural Coatings.
 4. Comply with local Code requirements and authorities having jurisdiction for flame spread and smoke developed ratings of paints and coatings.
 5. Conform to requirements of local authorities having jurisdiction in regard to the storage, mixing, application, and disposal of all paint and related waste materials.
 6. All materials, preparation, and workmanship shall conform to requirements of the latest edition of the Architectural Paint Specification Manual by MPI.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle materials according to manufacturers recommendations.

1.07 ENVIRONMENTAL/PROJECT REQUIREMENTS

- A. Job Conditions:
 - 1. Paint: Apply only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F and 95 degrees F.
 - 2. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
 - 3. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.08 MAINTENANCE

- A. Provide set of properly labeled drawdowns for future reorder of paint.
- B. Provide not less than 1 quart for each paint and color used on site for owner touch-up.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Paint:
 - 1. Standard of Quality: Design is based on products of Sherwin-Williams Company (S-W), except as noted.
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers are:
 - a. Glidden Professional/Devoe Coatings
 - b. PPG Industries, Pittsburgh Paints www.ppg.com
 - c. Diamond Vogel www.diamondvogel.com
 - d. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS GENERAL

- A. Material Compatibility: Provide blockfillers, primers, finish coat materials and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

- B. Material Quality:
1. Provide manufacturer's best quality trade sale paint material of the various coating types specified.
 2. Paint containers not displaying manufacturer's product identification will not be acceptable.
 3. Paint shall be ready-mixed and pre-tinted.
 4. Colors: As selected by architect from manufacturer's full range..
 5. Microban Antimicrobial Protection: Inhibits growth of stain and odor-causing bacteria, mold, mildew, and other fungal growth on the dried paint film. EPA approved; NSF approved (National Sanitation Foundation).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work. Maximum acceptable moisture content of substrates:
1. Masonry (clay and CMU): 12 percent.
 2. Gypsum Board: 12 percent.
 3. Concrete: 12 percent.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Coordination of Work:
1. Steel surfaces with less than 1.0 meter clear working access may necessitate applying material to inaccessible surfaces prior to erection of the finished steel members, either at the point of fabrication or on-site.
 2. Review other sections in which primers are provided to ensure compatibility of total systems for various substrates.
 3. On request of architect, furnish information on characteristics of finish materials to ensure use of compatible primers.
 4. Notify architect of problems anticipated using the materials specified.
 5. Commencement of installation signifies acceptance of surface conditions.
- D. Factory-Primed Materials:
1. Supplier shall disclose to the general contractor and to the painting contractor any pre-treatment and temporary coatings which have been applied.
 2. Manufacturer/supplier shall provide certification that the specified surface preparation and priming has been performed.
 3. Galvanized Metal:
 - a. Remove pre-treatment and temporary coatings.

3.02 PROTECTION

- A. Protect work of other trades and property of owner against paint damage and overspray.
- B. Sealants at expansion joints shall be masked prior to application of coating system.
- C. Warning Signs: Provide “wet paint” signs to protect newly painted finishes.

3.03 SURFACE PREPARATION

- A. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted.
 - 1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 2. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning General:
 - 1. Clean substrates of dust, dirt, grease, mildew, or other substances that could impair the bond of the various coatings according to manufacturer’s written instructions for each particular substrate condition and as specified.
 - 2. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
 - 3. Provide barrier coats over incompatible primers or remove and re-prime.
- C. Cementitious Substrates:
 - 1. Comply with SSPC-SP13.
 - 2. Prepare concrete, concrete masonry block, surfaces to be painted.
 - 3. Determine alkalinity and moisture content of surfaces by performing appropriate tests.
 - a. Perform pH test prior to application of coating system to ensure pH is within acceptable levels.
 - b. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application.
 - c. Do not paint surfaces where moisture content exceeds that permitted in manufacturer’s printed directions.
 - 4. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents.
 - 5. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 - 6. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner.
 - 7. Flush the floor with clean water to remove acid, neutralize with ammonia, and rinse.
 - 8. Allow to dry and vacuum before painting.

- D. Gypsum Drywall Substrate:
1. Surface to be clean and dry.
 2. Set and spackle nail heads, sand smooth, remove dust.
 3. Spackle exterior surfaces with exterior grade compounds.
- E. Ferrous Metal Substrates:
1. Clean nongalvanized ferrous-metal surfaces that have not been shop coated.
 2. Remove oil, grease, dirt, loose mill scale, and other foreign substances.
 3. Surface shall be free of all visible rust.
 4. Use solvent or mechanical cleaning methods that comply with recommendations of the SSPC.
 5. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 6. For application of aluminum (metallic) paint to steel surface, use alkyd anticorrosive or quick-drying alkyd metal primer.
- F. Galvanized Surfaces:
1. Clean per SSPC-SP1.
 2. Use non-petroleum-based solvents so surface is free of oil and surface contaminants.
 3. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
 4. For application of metallic (aluminum) paint: Galvanized steel must weather a minimum of 6 months prior to coating.

3.04 PAINT PREPARATION

- A. Mixing:
1. Carefully mix and prepare paint materials according to manufacturer's directions.
 2. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 3. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material.
 4. Remove film and, if necessary, strain material before using.
 5. Filter metallic (aluminum) paint slowly through a 55 mesh screen.
 6. Use only thinners approved by the paint manufacturer, and only within recommended limits.
- B. Tinting:
1. Tint each coat progressively lighter to enable confirmation of number of coats.

3.05 APPLICATION

- A. General:
1. Apply paint according to manufacturer's directions.
 2. Use applicators and techniques best suited for substrate and type of material being applied.

3. Do not use heat guns with lead-based paints.
 4. Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- B. Multiple Coats:
1. The number of coats and film thickness required is the same regardless of the application method.
 2. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
 3. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
 4. Sand between applications where sanding is required to produce an even smooth surface according to manufacturer's directions.
- C. Tolerances:
1. Match approved samples for color, texture, and coverage.
 2. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance.
 3. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
- D. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate. Provide a total dry film thickness (DFT) of the entire system as recommended by manufacturer.
- E. Extent of Work:
1. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 2. Paint surfaces behind movable equipment and furniture and wall-mounted items same as similar exposed surfaces.
 3. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
 5. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 6. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
 7. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
 8. Sand lightly between each succeeding enamel or varnish coat.

- F. Mechanical and Electrical Work:
1. Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces including, but not limited to:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Tanks that do not have factory-applied final finishes.
 - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - h. Electrical equipment indicated to have a factory-primed finish for field painting.
- G. Blockfillers: Apply blockfillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- H. Prime Coats:
1. Before application of finish coats, apply a prime coat of material as recommended by manufacturer to material that is required to be painted or finished and has not been prime coated by others.
 2. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

3.06 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following procedure at any time and as often as owner deems necessary during the period when paints are being applied:
1. Owner will engage the services of a qualified testing agency to sample paint materials being used.
 2. Samples of material delivered to Site will be taken, identified, sealed and certified in presence of contractor.
 3. Testing agency will perform tests for compliance of paint materials with product requirements.
 4. Owner may direct contractor to stop applying paints if test results show materials being used do not comply with product requirements.
 5. Contractor shall remove noncomplying paint materials from Site, pay for testing, and repaint surfaces painted with rejected materials.
 6. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the 2 paints are incompatible.

3.07 CLEANING, ADJUSTING, AND PROTECTION

- A. At the end of each workday, remove empty cans, rags, rubbish, wash water, solvents, and other discarded paint materials from the Site.
- B. Do not clean painting equipment with free draining water. Retain cleaning water and filter out sediments to reduce contaminants entering waterways, drain systems, or into the ground.
- C. Clean glass and paint-spattered surfaces by washing and scraping, using care not to scratch or damage adjacent finished surfaces.
- D. Remove, refinish, or repaint Work not in compliance with specified requirements.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- F. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.08 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metal, Zinc-Coated Metals (Including but not limited to hollow metal doors and frames and exposed structural steel lintels and framing).
 - 1. Prep Galvanized steel items as recommended by paint manufacturer.
 - 2. Waterborne self-cross-linking acrylic primer.
 - a. Minimum DFT: 2.0 mils (over iron and steel).
 - b. Minimum VS: 39 percent.
 - c. S-W: Pro-Cryl Universal Primer B66.
 - 3. 2-component acrylic polyurethane high gloss:
 - a. 1 finish coat.
 - b. Minimum DFT: 4.0 mils.
 - c. Minimum VS: 57 percent.
 - d. Sheen: 30 to 50 units at 60 degrees.
 - e. S-W: Acrolon 218 HS Acrylic Polyurethane Semigloss B65.

3.09 INTERIOR PAINT SCHEDULE

- A. Concrete Masonry Units:
 - 1. Walls:
 - a. Blockfiller: Latex-based, blockfiller:
 - 1) Minimum DFT: 8 mils.
 - 2) Minimum VS: 48 percent.
 - 3) Apply 2 coats if required by substrate.
 - 4) S-W: PrepRite Blockfiller B25W25.

- b. Semigloss interior latex enamel:
 - 1) 2 finish coats.
 - 2) Minimum DFT: 1.5 mils.
 - 3) Minimum VS: 38 percent.
 - 4) S-W: ProMar 200 Latex Semi-Gloss Interior B31-200.
- B. Gypsum Board:
 - a. Primer: Vinyl acrylic:
 - 1) Minimum DFT: 1.1 mils.
 - 2) Minimum VS: 26 percent.
 - 3) S-W: PrepRite 200 Latex Wall Primer B28W200.
 - b. Low-luster, acrylic-latex, interior enamel (typical):
 - 1) 2 finish coats.
 - 2) Minimum DFT: 1.6 mils per coat.
 - 3) Minimum VS: 37 percent.
 - 4) Sheen: 10 to 20 units at 85 degrees.
 - 5) S-W: ProMar 200 Latex Eg-Shel B20W, 1200 Series.
- 2. Ceilings:
 - a. Primer: Latex-based, interior primer.
 - 1) Minimum DFT: 1.1 mils.
 - 2) Minimum VS: 26 percent.
 - 3) S-W: PrepRite 200 Latex Wall Primer B28W200.
 - b. Flat, vinyl acrylic interior paint.
 - 1) 2 finish coats.
 - 2) Minimum DFT: 1.2 mils per coat.
 - 3) Minimum VS: 37 percent.
 - 4) Sheen: 0 to 5 units at 85 degrees.
 - 5) S-W: ProMar 400 Flat Latex B30W400 Series.
- C. Ferrous and Zinc-Coated Metal (Including but not limited to hollow metal doors and frames and exposed structural steel framing and lintels):
 - 1. Primer: Quick-drying, rust-inhibitive, waterborne, self-cross-linking acrylic primer:
 - a. Minimum DFT: 2.0 mils.
 - b. Minimum VS: 39.
 - c. S-W: Pro-Cryl Universal Primer B66.
 - 2. Semigloss, alkyd-enamel odorless finish:
 - a. 2 finish coats.
 - b. Minimum DFT: 3.4 mils.
 - c. Minimum VS: 43 percent.
 - d. Sheen: 40 to 50 units at 60 degrees.
 - e. S-W: ProMar Alkyd Semi-Gloss B34W200 Series.
- D. Color Schedule:
 - 1.Paint-1: SW0023 Pewter Tankard.
 - 2.Paint-2: SW7102 White Flour.
 - 3.Paint-3: SW7671 On the Rocks.
 - 4.Paint-4: Black

DIVISION 10 - SPECIALTIES

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Panel signs:
 - a. Room identification signs.

1.02 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- C. Shop Drawings: Submit Shop Drawings showing elevations, large-scale sections of typical members and other components, mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
- D. Samples:
 - 1. Color Samples: Submit manufacturer's standard color samples with Product Data and Shop Drawings.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide interior signage systems made of components of standard construction furnished by one manufacturer as coordinated assemblies for each system.
- B. Qualifications:
 - 1. Manufacturer: 5 years' experience in the manufacture of interior signage.
- C. Certifications:
 - 1. Submit certification that signage meets handicapped standards specified.
 - 2. Submit independent certification that Braille is correct for stated text.
- D. Regulations Requirements:
 - 1. Comply with applicable provisions in:
 - a. International Building Code as noted on the Drawings.
 - b. ANSI A117.1.

1.04 WARRANTY

- A. Manufacturer's and Installer's standard 1 year warranty for materials and installation.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Standard of Quality:
 - 1. Standard of Quality is based on Series 1000 ADA System as manufactured by Mohawk Sign Systems.
- B. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - 1. ASI Sign Systems, Inc. www.asimodulex.com
 - 2. Braille-Tac Division of Advance Corporation, Cottage Grove, MN www.brailletacsigns.com
 - 3. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS AND FABRICATION

- A. Panel Signs:
 - 1. Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 - 2. Sign surface shall remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.
 - 3. Frames:
 - 4. Sign Panels:
 - a. Materials: Modified acrylic
 - b. Size: as scheduled.
 - c. Graphic process: Raised copy; 1/32 inch minimum.
 - d. Lettering: Upper case characters in size as indicated on the Drawings, or if not indicated, 5/8-inch (minimum), 2 inches (maximum).
 - e. Font: Helvetica Medium.
 - f. Braille: Include text (grade 2).
 - g. Finish: ADA compliant matte finish in colors selected by architect from manufacturer's standard color palette.
 - h. Pictogram: As indicated by text on 6 inch high (minimum) background.
- B. Panel Signage Types (See attached Schedule at end of section):
 - 1. Panel Type-1 "Restroom Signs": 8 inches high by 8 inches long, including brail and pictogram.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that interior signage may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. Install plumb, true, square in neat, rigid, substantial manner.
- B. Install in compliance with manufacturer's written instructions.
- C. Location:
 - 1. Install signs on walls adjacent to latch side of door where applicable.
 - 2. Where not indicated or possible, install signs on nearest adjacent walls.
 - 3. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- D. Mounting System:
 - 1. Provide concealed, vandal resistant fasteners.

3.03 SCHEDULE

- A. Provide following text on individual panel signs as specified:
 - 1. Panel Signs:
 - a. Panel Type "1"

<u>Quantity</u>	<u>Text</u>	
(2)	WOMEN	with Pictogram and brail MS1 symbol per Mohawk
(2)	MEN	with Pictogram and brail MS2 symbol per Mohawk
(1)	RESTROOM	with Pictogram and brail MS5 symbol per Mohawk

SECTION 10 21 20 - REINFORCED COMPOSITE TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide solid color reinforced composite (SCRC) toilet enclosures:
 - 1. Toilet compartments.
 - 2. Urinal Screens.

3. Toilet room accessories including, but not limited to:
 - a. Headrail.
 - b. Hardware.
 - c. Anchorages and fasteners.
 - d. Latch.
 - e. Coat hook.
- B. Related Sections:
 1. Section 09 30 00 - Tiling
 2. Section 10 28 13 - Toilet Accessories

1.02 REFERENCES

- A. ADA - Accessibility
- B. ANSI A117.1 - Accessibility
- C. ASTM:
 1. D2197 - Adhesion of Organic Coatings by Scrape Adhesion
 2. D2794 - Resistance of Organic Coatings to Impact
 3. D6578 - Determination of Graffiti Resistance
 4. E84 - Surface Burning Characteristics
- D. NFPA 101 Life Safety Code, 2000 Edition

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 1. Toilet Partition System:
 - a. Overhead braced.
 - b. Vandal resistant.
- B. Performance Requirements:
 1. Graffiti Resistance and Cleanability: 5 required staining agents shall be cleaned off material per ASTM D6578.
 2. Scratch Resistance: Maximum Load Value shall exceed 10 kilograms per ASTM D2197.
 3. Impact Resistance: Maximum Impact Force value shall exceed 30 inch pounds per ASTM D2794.
 4. Fire Resistance: Comply with ASTM E84:
 - a. Smoke Developed Index: Not to exceed 450.
 - b. Flame Spread Index: Not to exceed 75.
 - c. Material Fire Ratings:
 - 1) NRPA: Class B.
 - 2) ICC: Class B.

1.04 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings: Show system fabrication, installation drawings, including plans, elevations, sections, details of components, and configurations within system and between system and adjoining system. Show locations of cutouts and reinforcements for compartment-mounted toilet accessories.
- D. Samples:
 - 1. Initial Selection: Submit manufacturer's standard color samples for each type of finish with Product Data and Shop Drawings.
 - 2. Verification: Prior to shipping, submit each type of finish indicated; in sets for each color, texture, and pattern specified.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide toilet compartments units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Field Samples: If requested, furnish sample of each type of toilet compartments to E/A for review prior to manufacture/installation. E/A will forward approved sample to the Site for installation.

1.06 PROJECT CONDITIONS

- A. Drawings do not purport to show actual dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 WARRANTY

- A. Provide 25-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.
- B. Provide 1-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Standard of Quality: Design is based on 1092.67 Sierra Series by Bobrick Washroom Equipment www.bobrick.com or equal from other manufacturers.

2.02 MATERIALS

- A. Toilet Partition Components:
 - 1. Solid Color Reinforced Composite material composed of dyes, organic fibrous material, and polycarbonate/phenolic resins.
 - 2. Non-ghosting, graffiti-resistant surface integrally bonded to core through thermal and mechanical pressure.
 - 3. Edges of Material: Same color as surface.
 - 4. Color: As selected by E/A from manufacturer's standards.
- B. Headrail: Continuous 16 gauge stainless steel with anti-grip profile.
- C. Hardware:
 - 1. Institutional: 18-8 S type, extra heavy-duty, 304 stainless steel with satin finish.
 - 2. Reinforced latch with through-bolted keeper.
 - 3. Vandal-resistant fasteners have Pin-in-Head Torx Screw heads exposed on the exterior and interior of toilet compartment.
 - 4. Threaded Inserts: Factory-installed brass inserts for securing door hinges, door latch, and door stops.
 - 5. Each insert to withstand over 1,500 pounds of pull force when properly installed.
 - 6. Vandal-resistant, Pin-in-Head Torx Screws attach hinges, door stops, door latch keepers and mounting hardware.
- D. Urinal Screens:
 - 1. Wall-hung (1095 Sierra). Use 11 gage double thickness brackets.
 - 2. Height: 42-inches.
- E. Other Materials: Other materials not specifically described but required for complete, proper installation of toilet compartments, subject to acceptance of E/A.

2.03 FABRICATION

- A. Doors, Panels, and Pilasters:
 - 1. Thickness:
 - a. Panels: 1/2 inch.
 - b. Doors, stiles: 3/4 inch.
 - 2. Fabricate pilasters for partition system.
 - 3. Overhead Braced Partitions:
 - a. Leveling device: 7-gage, 3/16-inch hot-rolled steel bar, chromate-treated and zinc-plated; through-bolted to base of stile.
 - b. Shoe:
 - 1) One-piece, 3-inch-high, 22-gage 304 stainless steel with satin finish.
 - 2) Capable of being fastened by clip to stiles starting at wall line.

- 3) Furnish shoe at each pilaster to conceal supports and leveling mechanism.
 - 4) Minimum 2-inch penetration into 3-inch-thick structural floor.
4. Equip each compartment in partition system as follows:
- a. Latch:
 - 1) ADA approved latch and keeper, designed for emergency access.
 - 2) Sliding door latch, 14-gage, on nylon track.
 - 3) Requiring less than 5-pound force to operate.
 - 4) Attach to door by machine screws into factory-installed brass inserts.
 - b. Hinges, Stop Plates, Bumpers:
 - 1) 16 gage continuous piano hinge.
 - 2) Through-bolted panel-to-stile U channel and spring-loaded, self-closing hinge run full height of panels and doors.
 - 3) Furnish door with two vandal-resistant 11-gage stainless steel door stop plates with attached rubber bumpers.
 - c. Coat Hook and Bumper:
 - 1) Provide wall-mounted bumpers for out-swinging doors.
 - 2) Stainless steel.
 - 3) Project no more than 1 1/8 inch from face of door.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that Work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that toilet compartments may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection: Protect installed work and materials of other trades.
- B. Provide wall backing to secure the mounting brackets of panels, stiles, and wall posts.

3.03 INSTALLATION

- A. Install plumb, true, square in neat, rigid, substantial manner.
- B. Follow manufacturer's recommendation for backing and proper support.

- C. Conceal evidence of drilling, cutting, and fitting to room finish.
- D. Maintain uniform clearance at vertical edge of doors.

3.04 REPAIR/RESTORATION

- A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

3.05 ADJUSTING

- A. Adjust units to operate in proper manner and easily without binding.
- B. Set hinge cam on in-swinging doors to hold doors open when unlatched.
- C. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

3.06 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.
- B. System: Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer.

3.07 PROTECTION

- A. Provide protection as necessary to prevent damage during remainder of construction period.

SECTION 10 28 13 - TOILET ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Grab bars.
 - 2. Toilet paper dispenser.
 - 3. Soap dispenser.
 - 4. Waste receptacle.
 - 5. Sanitary napkin disposal unit.
 - 6. Channel frame mirror.
 - 7. Mop clip strip.
 - 8. Electric hand dryer.
 - 9. Infant changing table.
 - 10. Sharps Receptacle

- B. Related Sections:
 - 1. Section 04 20 00 - Unit Masonry Assemblies
 - 2. Section 06 40 23 - Interior Architectural Woodwork
 - 3. Section 09 30 00 - Tiling

1.02 REFERENCES

- A. ASTM:
 - 1. A666 - Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, Flat Bar
 - 2. C1503 - Silvered Flat Glass Mirror
 - 3. F446 - Grab Bars and Accessories for Bathing Areas

1.03 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage, and installation instructions including construction details and dimensions, anchoring and mounting details, requirements for cutouts and substrate preparation, and maintenance recommendations.

1.04 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of toilet accessories.
 - 2. Contractor: 3 years experience in the installation of toilet accessories.
 - 3. Personnel: For actual installation of toilet accessories, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of Work.

1.05 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.06 PROJECT CONDITIONS

- A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form, agreeing to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. General Toilet Accessories:
 - 1. Standard of Quality: Unless otherwise indicated, design is based on products of Bradley Corp. www.bradleycorp.com
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. American Specialties www.americanspecialties.com
 - b. Bobrick Washroom Equipment Inc. www.bobrick.com
 - c. Manufacturer of comparable products meeting requirements of specifications.
- B. Electric Hand Dryers:
 - 1. Standard of Quality: Design is based on XLERATOR Model XL-W from Excel Dryers, Inc. www.exceldryer.com.
 - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Airforce by World Dryer www.worlddryer.com
 - b. Airblade by Dyson www.dyson.com
 - c. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. ASTM A666, 304 stainless steel with satin finish, unless otherwise specified below.
- B. Mirrors:
 - 1. ASTM C1503 - Mirror Glazing Quality.
 - 2. Clear glass.
 - 3. Nominal 6.0 mm thick.

2.03 PRODUCTS

- A. Grab Bars:
 - 1. 1-1/2 inch diameter; 18 gage tubing; safety grip finish; vandal resistant concealed mounting: 812 Series.
 - 2. Grab bars shall be capable of supporting minimum dead load of 250 pounds.
- B. Toilet Paper Dispenser:
 - 1. Dual Roll: Non-controlled delivery; Model 5234 at handicapped accessible toilet stalls.

2. Dual Roll: Controlled delivery; Model 5224 at non-handicapped accessible toilet stalls.
- C. Soap Dispensers:
1. Wall Mount, foaming touch free dispenser.
 2. Model: GOJO TFX
- D. Waste Receptacle: 22 gage with seamless exposed surfaces; Removable 18 gallon receptacle with heavy duty vinyl liner:
1. Recessed (recesses 4 inches): Model 334.
- E. Sanitary Napkin Disposal Unit:
1. Surface mounted; 22 gage; Model 4781-15.
- F. Channel Framed Mirror: One-piece roll-formed stainless steel channel frame with tempered glass. 15-year warranty against silver spoilage.
1. Without Shelf: Model 781.
 2. See Drawings for size.
- G. Mop Clip Strip: 18 gage; surface mounted; 3 holders; Model 9953.
- A. Electric Hand Dryer:
1. Automatic, hands-free, warm air dryer.
 2. Cover: One-piece, vandal resistant, reinforced white thermoplastic.
 3. Finish: Electrostatically applied, chip resistant, white paint.
 4. Mounting: Surface Mounted.
 5. Power: 120V, 12.5 amps, 60 hz.
 6. Model: XL-W
- B. Infant Changing Station: Horizontal, wall mounted, fold-open, polyethylene with stainless steel hinges , 200 pound capacity.
1. Model: Koala Bear Kare Model KB-200.
 2. Color: Cream
- C. Sharps Receptacle:
1. Wall mounted, lockable cabinet
 2. Size: 5 quarts.
 3. Product: S-15309 by Kendall.
- D. Other Materials: Other materials not specifically described but required for complete, proper installation of toilet accessories, subject to acceptance of architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that toilet accessories may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protection: Protect installed work and materials of other trades.

3.03 INSTALLATION

- A. General Requirements:
 - 1. Install plumb, true, square in neat, rigid, substantial manner.
 - 2. Use theft-proof screws to install toilet accessories.
 - 3. Fasten to masonry with screws and expansion shields.
 - 4. Anchor grab bars securely. Install to withstand downward load of minimum 250 pounds per ASTM F446.
 - 5. After erection, clean surfaces, adjust hardware, leave in good operating condition.
- B. Electric Hand Dryer:
 - 1. Coordinate with section 06 40 23 for installation of solid surface material at electric hand dryers.

3.04 ADJUSTING AND CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from Work of this Section. Maintain premises in neat, orderly condition.
- B. Toilet Accessories:
 - 1. Adjust for unencumbered smooth operation.
 - 2. Remove protection film.
 - 3. Accessories to be free of dust, grime, streaks.
 - 4. Clean and polish exposed surfaces.

3.05 SCHEDULE

- A. See Drawings for quantity and location of toilet accessories.

SECTION 10 44 00 - SAFETY SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Fire extinguishers:
 - a. Dry chemical extinguisher.
 - b. Wall bracket.
 - c. Fire extinguisher cabinet:
- C. Related Sections:
 - 1. Section 04 20 00 - Unit Masonry Assemblies

1.02 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, rating and classification, dimensions of individual components and profiles, finishes, handling, storage and installation instructions, and maintenance recommendations.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide life protection specialties units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
- B. Regulatory Requirements:
 - 1. UL Listing: Provide portable fire extinguishers which are UL listed and bear UL "Listing Mark" for type, rating and classification of extinguisher listed.
 - 2. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10 "Portable Fire Extinguishers."

1.04 WARRANTY

- A. Provide manufacturer's 6-year warranty to repair or replace fire extinguishers and life safety equipment that fail in materials or workmanship.
- B. Fire extinguisher failures include, but are not limited to, failure of hydrostatic test according to NFPA 10 and faulty operation of valves or release levers.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Standard of Quality: Design is based on products of J.L. Industries, Bloomington, MN www.jlindustries.com

- B. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
 - 1. Amerex Corporation, Trussville, AL www.amerex-fire.com
 - 2. Larsens Manufacturing Company, Minneapolis, MN www.larsensmfg.com
 - 3. Nystrom, Brooklyn Park, MN www.Nystrom.com

2.02 COMPONENTS

- A. Fire Extinguishers:
 - 1. Fully charged and ready for use at final acceptance.
 - 2. Enameled-steel container with pressure-indicating gage.
 - 3. Size, type indicated in schedule at end of this section.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Standard Wall Hanger Brackets:
 - 1. Size according to fixture size where indicated by symbol on Drawings.
 - 2. Locate as indicated by Drawings.
- C. Fire Extinguisher Cabinets:
 - 1. Locate as indicated on drawings.
 - 2. Model: Ambassador, electrostatic white epoxy finish on steel.
 - 3. Trim Style:
 - a. Trimless.
 - b. Semi-recessed; projected 2-1/2 inches with rolled edges.
 - 4. Door Style: Full break glass with lock.
 - 5. Door Glazing: Tempered.
 - 6. Options:
 - a. Lock.
 - b. Provide handle meeting ADA requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify specialties may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Examine fire extinguishers and life safety equipment for proper charging and tagging. Remove and replace damaged, defective, or undercharged fire extinguishers.
- D. Discrepancies: Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. Install according to ADA code.
- B. Install plumb, true, square in neat, rigid, substantial manner.
- C. Install in compliance with requirements of authorities having jurisdiction.
- D. Clean surfaces, adjust hardware, leave in good operating condition.

3.03 SCHEDULE

Drawing Symbol	Size and Type	Rating	General Location
F.E.C.	10 pound ABC Dry Chemical (cabinet)	4A:80B:C UL	See Drawings
F.E.	10 pound ABC Dry Chemical (bracket)	4A:80B:C UL	See Drawings

SECTION 10 51 13 - METAL LOCKERS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Lockers.
 - 2. Locker accessories including, but not limited to:
 - a. Bases.

1.02 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance recommendations.
- C. Shop Drawings: Submit Shop Drawings showing system fabrication, installation drawings, including plans, elevations, sections details of components, joint locations and configurations within system and between system and adjoining system. Include locker numbering sequence information. From the Project Manual, include a copy of the specification section that applies.
- D. Samples:
 - 1. Initial Color Selection: Submit manufacturer's standard color samples for each type of finish with Product Data and Shop Drawings.
 - 2. Color Verification: Prior to shipping, submit each type of finish indicated; in sets for each color, texture, and pattern specified, showing a full range of variations expected in these characteristics. Include notification to architect if selection is not within specified price range.

3. Components: Submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components if requested by architect.
- E. Maintenance Manual: Provide to owner maintenance and warranty data in “Maintenance Manual” at Maintenance Demonstration at Substantial Completion.

1.03 QUALITY ASSURANCE

- A. Qualifications:
1. General: Provide metal locker units made of components of standard construction furnished by 1 manufacturer as coordinated assemblies.
 2. Manufacturer: 5 years experience in the manufacture of metal lockers.
 3. Contractor: 3 years experience in the installation of metal lockers.
 4. Personnel: For actual installation of metal lockers, use personnel skilled in work required, completely familiar with manufacturer’s recommended methods of installation, thoroughly familiar with requirements of work.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and handled metal lockers and accessories is accordance with manufacturer’s recommendations.

1.05 PROJECT CONDITIONS

- A. Drawings do not purport to show actual dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.06 WARRANTY

- A. Provide manufacturer’s standard 2-year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Standard of Quality: Design is based on List Industries, Inc., Deerfield Beach, FL www.listindustries.com
- B. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
1. Lyon Workspace Products, Aurora, IL www.lyonworkspace.com
 2. Republic Lockers, Canton, OH www.republicstorage.com
 3. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Sheet Steel: Mild cold-rolled and leveled steel, free from buckle, scale, surface imperfections.

- B. Fasteners: Cadmium, zinc or nickel plated steel; slotless type exposed bolt heads; self-locking nuts or locker washers for nuts on moving parts.

2.03 COMPONENTS

- A. Lockers: Fabricate the work true to dimensions, square, plumb, level, with hairline joints:
1. Lockers:
 - a. Bodies:
 - 1) Backs, sides, shelves and tops shall be fabricated from 24 gage (minimum) steel.
 - b. Frame:
 - 1) Sheet steel, 18 gage (minimum), formed in channel shape and welded together.
 - 2) Door strike: Full, continuous vertical door strike with rubber grommets.
 - c. Doors:
 - 1) All welded construction.
 - 2) 18 gage single sheet steel construction. ADA compliant combination friction catch door pull with padlock strike plate. Doors shall be constructed to accept padlocks.
 - 3) Doors shall be louvered.
 - d. Hinges: 16 guage continuous piano hinge, welded to the frame, riveted to door or opposite; non-removable pin.
 - e. Model: Superior Classic KD Box Lockers.
 - 1) Size: 12 inches deep by 12 inches wide by 60 inches high, 5 tier.
 - 2) Location: As shown on drawings.
- B. Locker Accessories:
1. Number Plates: Recessed number plates, mechanically fastened; number sequence as directed by architect.
 2. Bases: Closed flush base where base; 16 gage (minimum); 4 inches high.
 3. Lock:
 - a. Padlock hasp; lock by others.
 4. Other Materials: Other materials not specifically described but required for complete, proper installation of metal lockers, subject to acceptance of architect.

2.04 FABRICATION, GENERAL

- A. Construction: Fabricate lockers square, rigid, without warp, with metal faces flat, free of dents or distortion; exposed metal edges safe to touch. Weld frame members together to form rigid, one-piece structure. Weld, bolt, or rivet other joints, connections. Grind exposed welds flush. Do not expose bolts or rivet heads on fronts of locker doors or frames. Sloped tops with end closures; closed flush base if no curb provided.

2.05 FINISH

- A. Shop Finish: Chemically pretreat metal with degreasing and phosphatizing process. Electrostatically apply baked-on enamel finish to surfaces, exposed and concealed, except plates and nonferrous metal.
- B. Color: Colors selected by architect from manufacturer's standards. Concealed parts may be manufacturer's standard neutral color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that metal lockers may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 INSTALLATION

- A. Metal Lockers: Install at locations shown according to manufacturer's instructions for plumb, level, rigid, flush installation.
- B. Fastenings: Space about 48 inches on center, unless otherwise recommended by manufacturer, apply through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

3.03 REPAIR/RESTORATION

- A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

3.04 ADJUSTING

- A. Adjust units to operate in proper manner and easily without binding.

3.05 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.

DIVISION 12 - FURNISHINGS

SECTION 12 48 16 - FLOOR GRILLES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide floor grilles and recessed frames.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete
 - 2. Section 03 35 22 – Mechanically Polished Concrete
 - 3. Section 08 43 13 – Aluminum-Framed Storefront

1.02 REFERENCES

- A. ASTM:
 - 1. B117 - Aluminum Product Corrosion to Salt
 - 2. C1028 - Static Coefficient of Friction

1.03 SYSTEM DESCRIPTION

- A. Design Requirements: Provide recessed aluminum entrance floor mat system which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1.04 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Product Data: Submit manufacturer's current Product Data including specifications, installation instructions, substrate preparation for each type of substrate, and maintenance and cleaning recommendations.
- C. Shop Drawings: Submit Shop Drawings showing system fabrication, installation drawings, including plans, details of components, and configurations within system and between system and adjoining system.
- D. Samples:
 - 1. Submit samples for each type and color of exposed entrance mat, frames, and accessories required.
 - 2. Provide 12-inch square samples of mat materials.
- E. Maintenance Manual: Provide to owner maintenance and warranty data in "Maintenance Manual" at Maintenance Demonstration at Substantial Completion.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide floor grille system units made of components of standard construction furnished by 1 manufacturer as coordinated assembly.
- B. Qualifications:
 - 1. Manufacturer: 5 years experience in the manufacture of floor grille systems, with 6 projects of similar size, scope and type of which 3 have been in successful use for 3 years or longer.
 - 2. Contractor: 3 years experience in the installation of floor grille systems.
 - 3. Personnel: For actual installation of floor grille systems, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

1.06 PROJECT CONDITIONS

- A. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.07 WARRANTY

- A. Provide manufacturers standard 10-year limited warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Standard of Quality: Design is based on Dual Track Foot Grille as manufactured by MATS, Inc., Stoughton, MA www.matsinc.com
- B. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
 - 1. Arden Architectural Specialties, St. Paul, MN www.ardenarch.com
 - 2. McGill Architectural Products, Pickering, ON, Canada www.themcgillgroup.com
 - 3. Pawling Corp, Wassauc, NY www.pawling.com
 - 4. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS AND FABRICATION

- A. Floor Grille:
 - 1. Comply with requirements of ASTM B117 and C1028.
 - 2. Construction: Bolt-through design with individual aluminum spacers.
 - 3. Material: Aluminum alloy type 6061-T6.

4. Blades:
 - a. T-shaped blades, 1-5/16-inch by 1/8-inch by 1 1/2 inch.
 - b. Combined with T-shaped blades size 1 1/16-inch by 1/8-inch by 1 1/2-inch with an anti-slip polymer C9065 insertion of Durometer 90/65, 1/4-inch-thick locked in at each end.
 5. Depth: Grille depth to be 1-1/2 inches and 1-5/8 inches including frame.
 6. Spacing Between Blades: Not to exceed 3/16 inch.
- B. Aluminum Recessed Frame:
1. General:
 - a. Preassembled at factory, incorporated welded construction for joints.
 - b. Provide invisible section divided integrated and welded within frame for each grille section.
 - c. Ship fully assembled.
 2. Integral with Concrete Substrate:
 - a. Perimeter frames: Inverted “T” shape.
 - b. Product: VV by Mats, Inc.
- C. Accessories:
1. Grout: Non-shrinking.
 2. Hinges: Stainless steel.
 3. Key Lock-downs: Galvanized steel (GB 46) attached to each grid section.
 4. Other materials: Other materials not specifically described but required for complete, proper installation of floor mat systems, subject to acceptance of architect.

2.03 FINISH

- A. Grating System Inserts:
1. Color: As selected by architect from manufacturer’s standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.
- B. Verification of Conditions: Verify that floor grille systems may be installed according to original design, pertinent codes and regulations, and pertinent portions of referenced standards.
- C. Discrepancies: Immediately notify architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

- A. Protect installed work and materials of other trades.
- B. Coordinate with adjacent work to ensure proper clearances and to prevent tripping hazards.

3.03 INSTALLATION

- A. Comply strictly with manufacturer's instructions and recommendations.
- B. Provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning.
- C. Joints:
 - 1. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes.
 - 2. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- D. Install foot grilles square and level with finished floor to permit smooth transition.
- E. Do not allow any free space between intermediary supports (or the pan) and the liquid cement.
- F. Set frame in with non-shrinking grout.
- G. Ensure there will be no traffic of any kind on the grilles, frames, and intermediary supports during the drying period of the non-shrinking grout.
- H. Once the grout has dried, clean the frame and pan of all construction debris. Ensure frames and intermediary supports are clean before setting grates in place.

3.04 REPAIR/RESTORATION

- A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

3.05 CLEANING

- A. Site: Do not allow accumulation of scraps, debris arising from work of this Section. Maintain premises in neat, orderly condition.
- B. System: Clean exposed surfaces of floor grille systems using materials and methods recommended by manufacturer.

3.06 DEMONSTRATION

- A. Maintenance Instructions: Manufacturer's Representative to schedule and attend meeting with owner's Representatives to explain:
 - 1. Maintenance and Care Instructions.
 - 2. Recommended Maintenance Program.
 - 3. Warranty Requirements.

3.07 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction and until Substantial Completion.

SECTION 12 75 50 - INTERIOR BENCHES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide:
 - 1. Interior bench seating.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete
 - 2. Section 03 35 22 – Mechanically Polished Concrete

1.02 SUBMITTALS

- A. Make submittals according to requirements of Division 01.
- B. Submit:
 - 1. Manufacturer's current Product Data, including specifications, handling, storage and installation instructions, and maintenance recommendations.
 - 2. Shop Drawings.
 - 3. Manufacturer's standard color samples.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide bench units as coordinated assemblies made from components of standard construction furnished by 1 manufacturer for each system.
- B. Qualifications:
 - 1. Manufacturer:
 - a. 5 years experience in the manufacture of benches.
 - b. Provides established program for return and reuse of foam packaging materials.

2. Contractor: Use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation and thoroughly familiar with requirements of Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Interior Benches:
 1. Accepted Manufacturer: Design is based on Arcata benches by Landscape Forms, Inc. Kalamazoo, MI (www.landscapeforms.com), DuMor Site Furnishings, Inc (www.dumor.com) subject to compliance with requirements, acceptable manufacturers and products are:
 - a. Manufacturer of comparable products meeting requirements of specifications.

2.02 MATERIALS

- A. Interior Bench Seating:
 1. Size: 17-inch deep by 18-inch high by 74-inches long, backless with no arms.
 2. Pedestals:
 - a. Steel tubes, plates and angles with welded construction
 - b. Mounting: Surface mounted with baseplate for anchoring to concrete floor slab.
 - c. Finish: Polyester powder coat enamel.
 - 1) Color: Black.
 3. Wood:
 - a. Attach to steel frame with concealed fasteners.
 - b. Species: Red oak.
 - c. Color: One coat of stain, color to be selected by architect.
 - d. Finish: One coat catalyzed lacquer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's recommendations.
- B. Install benches level.
- C. Benches shall be anchored securely in place.

3.02 REPAIR

- A. Touch up scratched or damaged surfaces of wood and steel frames.

3.03 CLEANING

- A. After installation, clean all surfaces.

72. Rest Area 31 Building Plumbing, Item SPV.0105.03.

A Description

This work includes the electrical construction required to complete the rest area buildings according to the applicable plans, the 'General Requirements for Building Construction,' and the technical specifications.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Rest Area No. 31 Building Plumbing as a single lump sum 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.0105.03	Rest Area 31 Building Plumbing	LS

Payment is full compensation for furnishing all materials and equipment; and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

INDEX OF PLUMBING SPECIFICATIONS

22 05 00 Common Work Results for Plumbing
22 05 13 Common Motor Requirements for Plumbing Equipment
22 05 19 Meters and Gages for Plumbing Piping
22 05 23 General-Duty Valves for Plumbing Piping
22 05 29 Hangers and Supports for Plumbing Piping and Equipment
22 05 53 Identification for Plumbing Piping and Equipment
22 07 19 Plumbing Piping Insulation
22 11 16 Domestic Water Piping
22 11 19 Domestic Water Piping Specialties
22 11 23 Domestic-Water Pumps
22 13 16 Sanitary Waste and Vent Piping
22 13 19 Sanitary Waste Piping Specialties
22 31 00 Domestic Water Softeners
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22 34 36.23 Commercial, High-Efficiency, Gas Domestic Water Heaters
22 42 13.13 Commercial Water Closets
22 42 13.16 Commercial Urinals
22 42 16.13 Commercial Lavatories
22 42 16.14 Engineered Lavatory Decks and Faucets
22 42 16.16 Commercial Sinks
22 47 16 Pressure Water Coolers

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Mechanical demolition.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. PVC: Polyvinyl chloride plastic.

- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Mechanical sleeve seals.
- B. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

- D. Coordination Meetings: Attend coordination meetings with the construction manager and all other trades for the purpose of coordinating the locations of all fire protection, plumbing, HVAC and electrical work for the entire project. The goal of these meetings is to avoid conflicts between trades in the field.
 - 1. Conflicts Between Trades: Resolve all conflicts with other trades at no additional cost to the owner or architect.
- E. Ceiling Heights: Maintain all ceiling heights indicated on the architectural drawings. Ceiling heights will not be lowered to accommodate installation of fire protection, plumbing, HVAC or electrical work. Install all work so that there is at least eight (8) inches clearance above the ceiling grid, in all areas, to facilitate installation of light fixtures. If installed work does not comply with the ceiling height requirements stated above, then the contractor shall remove and re-install work to comply with the stated requirements above at no additional cost to the owner or architect.
- F. This contractor shall completely cooperate with all other trades in the matter of planning and executing of the work. Every reasonable effort shall be made to prevent conflict and interferences as to space requirements, dimensions, locations, openings, sleeving or other matters which tend to delay or obstruct the work of any trade.

1.08 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. These specifications and attendant drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material necessary for the proper execution of the work according to present practices of the trade shall not relieve the contractor from providing such additional labor and materials.
- B. The drawings depicting plumbing work are diagrammatic and show, in their approximate location, symbols representing plumbing equipment and devices. The exact location of such equipment and devices shall be established in the field according to instructions from the architect and/or established by manufacturer's installation drawings and details.
 - 1. The contractor shall refer to shop drawings and submittal drawings for all equipment requiring plumbing connections to verify rough-in and connection locations.
 - 2. Unless specifically stated to the contrary, no measurement of a plumbing drawing derived by scaling shall be used as a dimension to work by. Dimensions noted on the plumbing drawings are subject to measurements of adjacent and previously completed work. All measurements shall be performed prior to the actual installation of equipment.
- C. The plumbing drawings do not attempt to show the complete details of building construction which affect the plumbing installation. The contractor shall refer to plans of other trades for additional details which affect the proper installation of this work. Bring any discrepancies to the attention of the A/E for resolution. The contractor is cautioned that diagrams showing plumbing connections and/or piping are diagrammatic only and must not be used for obtaining linear runs of piping.

Piping diagrams do not necessarily show the exact physical arrangement of the equipment

1.09 EXAMINATION OF PLANS, SPECIFICATIONS AND SITE

- A. Before submitting a bid, the contractor shall visit the site and familiarize himself with all features of the building and site, which may affect the execution of his work. No extra payment will be allowed for the failure to obtain this information. If in the opinion of the contractor there are omissions or errors in the plans or specifications, the contractor shall clarify these points with the Engineer before submitting his bid. In lieu of written clarification by addendum, the contractor shall resolve all conflicts in favor of the greater quantity or better quality.

PART 2 PRODUCTS

2.01 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.

- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.03 TRANSITION COUPLINGS:

- A. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Unshielded, Nonpressure Transition Couplings: ASTM C 1173; elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- D. Shielded, Nonpressure Transition Couplings: ASTM C 1460; elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Pressure Transition Couplings: AWWA C219; corrosion-resistant metal sleeve-type with ductile iron center-sleeve and rubber gasket. Coupling shall be same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

2.04 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: ASSE 1079; factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: ASSE 1079; factory-fabricated, bolted, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Nipples: IAPMO PS 66; electroplated steel nipple complying with ASTM F 1545 with inert and noncorrosive, propylene lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.05 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Metraflex Co.
 - 3. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing element unit, designed for field assembly, for filling annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Glass-reinforced plastic.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.06 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD

2.07 SLEEVES

- A. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- F. Molded PVC Sleeves: With nailing flange for attaching to wooden forms.
- G. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- H. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.08 ESCUTCHEONS AND FLOOR PLATES

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- D. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- E. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.
- F. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.
- G. One-Piece, Floor-Plates: Cast-iron floor plate.
- H. Split-Casting, Floor-Plates: Cast brass with concealed hinge.

2.09 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. Escutcheons for New Piping: One-piece, cast-brass type with polished, chrome-plated finish, except as follows:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
 - c. Bare Piping in Unfinished Service Spaces and Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.

2. Escutcheons for Existing Piping: Split-casting brass type with polished, chrome-plated finish, except as follows:
 - a. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
 - b. Bare Piping in Unfinished Service Spaces and Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.
- M. Install floor plates for piping penetrations of equipment-room floors.
- N. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 1. New Piping: One-piece, floor-plate type.
 2. Existing Piping: Split-casting, floor-plate type.

3.02 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.03 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.04 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.05 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.06 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.07 PIPING CONNECTIONS

- A. Verify final equipment locations for roughing-in.
- B. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- C. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.08 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right-of-way for piping installed at required slope.

3.09 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.10 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3.

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.12 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes general requirements for single-phase general-purpose, horizontal, small motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- C. Motors 1/20 HP and Smaller: Shaded-pole type.
- D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 EXECUTION (NOT APPLICABLE)

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.
 - 5. Test plugs.
- B. Related Sections:
 - 1. Division 22 Section "Domestic Water Piping" for water meters inside the building.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.01 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Miljoco Corporation.
 - b. Terice, H. O. Co.
 - c. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
- a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.02 THERMOWELLS

- A. Manufacturer: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.03 PRESSURE GAGES

- A. Direct- and Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Miljoco Corporation.
 - b. Terice, H. O. Co.
 - c. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - d. Weiss Instruments, Inc.
 2. Standard: ASME B40.100.
 3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 6. Movement: Mechanical, with link to pressure element and connection to pointer.
 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 8. Pointer: Dark-colored metal.
 9. Window: Glass.
 10. Ring: Metal.
 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.04 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

- B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.05 TEST PLUGS

- A. Description: Test-station fitting made for insertion into piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- E. Core Inserts: EPDM self-sealing rubber.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
- J. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.

3.02 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

3.05 PRESSURE-GAGE SCALE-RANGE SCHEDULE

Scale Range for Water Piping: 0 to 160 psi.

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
 - 2. Bronze swing check valves.
 - 3. Bronze gate valves.
 - 4. Iron swing check valves.
 - 5. Iron, silent check valves.
 - 6. Iron gate valves.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.03 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. OS&Y: Outside screw and yoke.
- D. RS: Rising stem.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.05 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
 - 1. Grooved: With grooves according to AWWA C606.
 - 2. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ball Valves: Apollo Valves, Hammond Valve, Milwaukee Valve Company, NIBCO.
 - 2. Gate Valves: Hammond Valve, Milwaukee Valve Company, NIBCO.
 - 3. Check Valves: Hammond Valve, Milwaukee Valve Company, NIBCO, Watts.
- B. Bronze Ball Valves: MSS SP-110, two or three-piece bronze body with threaded ends, chrome-plated bronze ball, PTFE or TFE seat, 600 psig minimum CWP rating and blowout-proof bronze stem.
 - 1. NPS 2 and smaller: Full port.
- C. Rising Stem Gate Valves: MSS SP-80, Type 2, Class 125. ASTM B 62 bronze body with integral seat and screw-in bonnet; 200 psig minimum CWP rating; threaded ends; bronze stem, solid bronze wedge; graphite packing; malleable iron handwheel
- D. Bronze Swing Check Valves: MSS SP-80, Type 3, Class 125. ASTM B 62 bronze body with renewable bronze disc and seat, threaded ends; suitable for installation in a horizontal or vertical line with upward flow..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level or in vertical piping with upward flow.
 - 2. Silent Check Valves: In horizontal or vertical position, between flanges.

3.03 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Ball, or butterfly valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 1-1/2 and Smaller: Bronze swing check valves.
- B. Stainless steel valves with grooved ends may be used in stainless steel grooved piping in lieu of bronze or iron valves. Stainless steel valves must meet minimum performance criteria specified for bronze or iron valve.

3.05 VALVE APPLICATIONS

- A. Water Supply and Return Piping:
 - 1. Shutoff and Throttling Service:
 - a. NPS 2 and Smaller: Bronze gate valves two or three-piece ball valves.
 - 2. Check Valves in Vertical Piping:
 - a. NPS 2 and Larger: Silent check valves.

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING

PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe positioning systems.
 - 7. Equipment supports.

- B. Related Sections:
 - 1. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

- C. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line, Inc.
 - b. Flex-Strut Inc.
 - c. Unistrut Corporation; Tyco International, Ltd.
 - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with inturned lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel
 - 7. Metallic Coating: Electroplated zinc.

2.04 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.07 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.08 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

- E. Fastener System Installation: Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 4. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 - 6. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. C-Clamps (MSS Type 23): For structural shapes.
 - 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - 8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - 9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - 10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - 11.
 - 12. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Stencils.
 - 4. Valve tags.
 - 5. Warning tags.

1.03 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number,
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches high.

2.03 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
1. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 2. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.04 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

2.05 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Yellow background with black lettering.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- D. Pipe Label Color Schedule:
 - 1. Domestic Cold Water Piping:
 - a. Background Color: Dark Green.
 - b. Letter Color: White.
 - 2. Domestic Hot Water Piping:
 - a. Background Color: Light Green.
 - b. Letter Color: White.
 - 3. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.

3.04 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape: 1-1/2 inches, round.
 - 2. Letter Color: Black

3.05 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Supplies and drains for handicap-accessible lavatories and sinks.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application.

1.07 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok HP.
 - b. Knauf Insulation; 1000-Degree Pipe Insulation with ECOSE Technology Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. VOC limit for indoor applications: 80 g/L.
- D. ASJ Adhesive Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. VOC limit for indoor applications: 50 g/L.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. VOC limit for indoor applications: 50 g/L.

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. VOC limit for indoor applications: 50 g/L.

- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: 60 percent by volume and 66 percent by weight.
 - 4. Color: White.

2.05 SEALANTS

- A. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: Aluminum.
 - 5. VOC limit for indoor applications: 420 g/L
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: White.
 - 5. VOC limit for indoor applications: 420 g/L.

2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: White.
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 2. Finish and Thickness: Smooth: 0.020 inch thick .

2.09 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.10 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
 - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

2.11 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGuire Manufacturing.
 - b. Truebro; a brand of IPS Corporation.
 - c. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.08 FINISHES

- A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.

- C. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, three locations of threaded valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Underground piping.
 - 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. Insulation Material: Mineral fiber
 - 2. Insulation Thickness: 1 inch thick minimum.
 - 3. Factory-Applied Jacket: ASJ-SSL.
 - 4. Field-Applied Jacket: PVC on exposed piping in mechanical rooms or within 10' of floor in occupied spaces.
 - 5. Vapor Barrier Required: Yes.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. Insulation Material: Mineral fiber
 - 2. Insulation Thickness:
 - a. NPS 1-1/2 and Smaller: 1 inch thick minimum.
 - b. NPS 2 and Larger: 2 inch thick minimum.
 - 3. Factory-Applied Jacket: ASJ-SSL.
 - 4. Field-Applied Jacket: PVC on exposed piping in mechanical rooms or within 10' of floor in occupied spaces.
 - 5. Vapor Barrier Required: No.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - 1. Insulation Material: Mineral fiber
 - 2. Insulation Thickness: 1/2 inch thick minimum.

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Aboveground and under-building-slab domestic water pipes, tubes, and fittings inside buildings and to 5 feet from building for connection to new underground water service.
- B. Related Requirements:
 - 1. Division 33 for water-service piping outside the building from source to the point where water-service piping enters the building.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- G. Appurtenances for Grooved-End Copper Tubing:
 - 1. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.

2. Mechanical Couplings for Grooved-End Copper Tubing:
 - a. Copper-tube dimensions and design similar to AWWA C606.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating: 300 psig.

2.03 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B, Standard Weight, with ends matching joining method.
- B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
- C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface and threaded ends.
- E. Flanges: ASME B16.1, Class 125, cast iron.
- F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Shurjoint Piping Products.
 - c. Victaulic Company.
 2. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 3. Fittings for Grooved-End, Galvanized-Steel Pipe:
 - a. AWWA C606 for steel-pipe dimensions.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating:
 - 1) NPS 8 and Smaller: 600 psig.

2.04 STAINLESS-STEEL PIPING

- A. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 10.
- B. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.

- C. Appurtenances for Grooved-End, Stainless-Steel Pipe:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Shurjoint Piping Products.
 - c. Victaulic Company.
 2. Fittings for Grooved-End, Stainless-Steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
 3. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:
 - a. AWWA C606 for stainless-steel-pipe dimensions.
 - b. Stainless-steel housing sections.
 - c. Stainless-steel bolts and nuts.
 - d. EPDM-rubber gaskets suitable for hot and cold water.
 - e. Minimum Pressure Rating:
 - 1) NPS 8 and Smaller: 600 psig.

2.05 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.06 PEX PIPING

- A. Standard: PEX-a (Engel-Method Crosslinked Polyethylene) Piping: ASTM F 876/877.

PART 3 EXECUTION

3.01 EARTHWORK

- A. Comply with requirements in Division 31 Section for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Division 22 Section "Domestic Water Piping Specialties."
- G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- H. Rough-in domestic water piping for water-meter installation according to manufacturer's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.

- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping."
- R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 22 Section "Domestic Water Pumps."
- S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Division 22 Section "Meters and Gages for Plumbing Piping."
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

- F. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- G. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- H. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- I. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
- K. Install transition couplings at joints of dissimilar piping.
- L. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install supports for vertical stainless-steel piping every 15 feet.
- G. Support piping and tubing according to MSS SP-69 and manufacturer's written instructions.

3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.
 - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.06 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.07 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.08 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.09 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-Building-Slab:
 1. Domestic water, building-service piping:
 - a. NPS 3 and smaller: Soft copper tube, ASTM B 88, Type K wrought-copper, solder-joint fittings; and brazed joints.
- E. Aboveground domestic water piping:
 1. NPS 3 and smaller: Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
 - a. Stainless-steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.

3.11 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 4. Drain Duty: Hose-end drain valves.

- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Balancing valves.
 - 4. Temperature-actuated, water mixing valves.
 - 5. Strainers.
 - 6. Outlet boxes.
 - 7. Hose bibs.
 - 8. Wall hydrants.
 - 9. Drain valves.
 - 10. Water-hammer arresters.
 - 11. Water meters.
- B. Related Requirements:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Domestic Water Piping" for water meters.
 - 3. Division 22 Section "Pressure Water Coolers" for water filters for water coolers.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61.

2.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Chrome plated.
- B. Hose-Connection Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - d. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.04 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts model 9D or comparable product by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: NPS 3/4.
5. Body: Bronze.
6. End Connections: Union, solder joint.
7. Finish: Rough bronze.

B. Double-Check, Detector-Assembly Backflow Preventers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts 757DCDA or comparable product by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Conbraco Industries, Inc.
 - c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1048 and is FM Global approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Size: Same size as piping.
6. Body: Stainless steel.
7. End Connections: Flanged or grooved.
8. Configuration: Designed for horizontal or vertical, straight-through flow.
9. Accessories:
 - a. Valves: Outside-screw and yoke-gate type with flanged ends or gear operated butterfly valves with grooved connections and tamper switches on inlet and outlet.
 - b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

- C. Hose-Connection Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 2. Standard: ASSE 1052.
 3. Operation: Up to 10-foot head of water back pressure.
 4. Inlet Size: NPS 1/2 or NPS 3/4.
 5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
 6. Capacity: At least 3-gpm flow.

2.05 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. ITT Corporation; Bell & Gossett Div.
 - c. NIBCO Inc.
 - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
 3. Body: Brass or bronze.
 4. Size: Same as connected piping, but not larger than NPS 2.
 5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.06 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Primary, Thermostatic, Water Mixing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers; a division of Watts Water Technologies, Inc.
 - d. Symmons Industries, Inc.
 2. Standard: ASSE 1017.
 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
 4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
 5. Material: Bronze body with corrosion-resistant interior components.
 6. Connections: Threaded union inlets and outlet.
 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

8. Tempered-Water Setting: 120 deg F.
9. Tempered-Water Design Flow Rate: 15 GPM.
10. Pressure Drop at Design Flow Rate: 20.
11. Valve Finish: Rough bronze.
12. Piping Finish: Copper.

2.07 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.08 OUTLET BOXES

A. Clothes Washer Outlet Boxes :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. Oatey.
 - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - f. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or Stainless-steel box and faceplate.
4. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acorn Engineering Company.
 - b. IPS Corporation.
 - c. Oatey.
 - d. Plastic Oddities.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing. Provide with water hammer arrestor.

2.09 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products.
 - d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - e. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Nozzle and Wall-Plate Finish: Chrome plated.
9. Operating Keys(s): One with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products.
 - d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - e. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Chrome plated Vacuum Breaker:
 - a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
10. Operating Keys(s): One with each wall hydrant.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.

8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.12 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. Precision Plumbing Products, Inc.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Watts Drainage Products.
 - g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.13 WATER METERS

A. Displacement-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AALIANT; a Venture Measurement product line.
 - b. ABB.
 - c. Badger Meter, Inc.
 - d. Carlon Meter.
 - e. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
 - f. Schlumberger Limited; Water Services.
 - g. Sensus.
2. Description:
 - a. Standard: AWWA C700.
 - b. Pressure Rating: 150-psig working pressure.
 - c. Body Design: Nutating disc; totalization meter.
 - d. Registration: In gallons or cubic feet as required by utility company.
 - e. Case: Bronze.
 - f. End Connections: Threaded.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
- D. Install Y-pattern strainers for water on supply side of each pump.
- E. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Division 06.
- F. Install water-hammer arresters in water piping according to PDI-WH 201.

3.02 CONNECTIONS

- A. Comply with requirements for piping specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each backflow preventor according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.04 ADJUSTING

- A. Set field-adjustable flow set points of balancing valves.
- B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. In-line, sealless centrifugal pumps.

1.03 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.08 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 PRODUCTS

2.01 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:
- B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- C. Pump Construction:
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 - 2. Casing: Bronze, with threaded or companion-flange connections.
 - 3. Impeller: Plastic.
 - 4. Motor: Single speed, unless otherwise indicated.
- D. Capacities and Characteristics: See drawings.

2.02 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.03 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
 - 1. Type: Water-immersion temperature sensor, for installation in piping.
 - 2. Range: 65 to 200 deg F.
 - 3. Enclosure: NEMA 250, .
 - 4. Operation of Pump: On or off.
 - 5. Transformer: Provide if required.
 - 6. Power Requirement: 24 V, ac.
 - 7. Settings: Start pump at 110 deg F and stop pump at 120 deg F. Temperature set points shall be user-adjustable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- C. Install continuous-thread hanger rods and hangers of size required to support pump weight.
 - 1. Comply with requirements for hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Install thermostats in hot-water return piping.

3.03 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Division 22 Section "Domestic Water Piping Specialties."
- D. Comply with Division 26 Sections for electrical connections, and wiring methods.
- E. Connect thermostats to pumps that they control.

3.04 IDENTIFICATION

- A. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.05 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Set thermostats for automatic starting and stopping operation of pumps.
 - 5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 7. Start motor.
 - 8. Open discharge valve slowly.
 - 9. Adjust temperature settings on thermostats.

3.06 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.03 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.04 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.03 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings: ASTM C 1277 and ASTM C 1540; stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop

2.04 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

- D. Copper Pressure Fittings:
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.05 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 EXECUTION

3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.

2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
 - N. Install underground PVC piping according to ASTM D 2321.
 - O. Install engineered soil and waste drainage and vent piping systems as follows:
 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - P. Plumbing Specialties:
 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 - R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
 - S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
 - T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.03 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- F. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded, nonpressure transition couplings.
- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
 - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4 : Use dielectric flanges or flange kits.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.

4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to existing sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.07 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.08 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

- A. Aboveground, Soil, Waste and Vent Piping: Use any of the following piping materials for each size range:
 1. NPS 4 and smaller:
 - a. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 - b. Copper DWV tube, copper drainage fittings, and soldered joints.
 - c. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- B. Underground, Soil, Waste, and Vent Piping: Use any of the following piping materials:
 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Floor drains.
 - 2. Miscellaneous sanitary drainage piping specialties.
 - 3. Flashing materials.
- B. Related Requirements:
 - 1. Division 22 Section "Storm Drainage Piping Specialties" for storm drainage piping specialties, and drains.

1.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.05 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the products indicated or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.6.3 .
 - 3. FD-1: Floor drain with adjustable strainer head, flashing collar and reversible flashing collar. Provide with vandal proof screws.
 - a. Fixture: Josam 3000-A series
 - b. Body Material: Cast Iron.
 - c. Pipe Connection: 3"Ø NPS no-hub outlet.
 - d. Strainer: Chrome Plated.
 - 4. FD-2: Floor sink with flashing collar and reversible flashing collar.
 - a. Fixture: Josam 49703-NB series
 - b. Body Material: Cast Iron.
 - c. Pipe Connection: 3"Ø NPS no-hub outlet.
 - d. Strainer: Dome.
 - e. Additional Features: Vandal proof screws.
 - 5. FD-3: Floor sink with flashing collar and reversible flashing collar.
 - a. Fixture: Josam 49360-A series
 - b. Body Material: Cast Iron.
 - c. Pipe Connection: 3"Ø NPS no-hub outlet.
 - d. Strainer: Dome.
 - e. Additional Features: Aluminum Sediment bucket and full grate with 2-1/2" opening. Vandal proof screws.
 - 6. FD-4: Floor drain, 12" round and 8" deep with clamping device.
 - a. Fixture: Josam 32330-SD series
 - b. Body Material: Cast Iron.
 - c. Pipe Connection: 4"Ø NPS no-hub outlet.
 - d. Strainer: Supplementary.
 - e. Additional Features: Sediment bucket and full grate.

2.02 ROOF FLASHING ASSEMBLIES

- A. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
1. Open-Top Vent Cap: Without cap.

2.03 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets
1. Size: Same as connected waste piping.
- B. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
1. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 2. Body: Bronze or cast iron.
 3. Inlet: Opening in top of body.
 4. Outlet: Larger than inlet.
 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- D. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
1. Size: Same as connected stack vent or vent stack.

2.04 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
1. General Applications: 12 oz./sq. ft..
 2. Vent Pipe Flashing: 8 oz./sq. ft..

- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated. Floors will be pitched to drains. Coordinate with general contractor for floor heights at drain locations.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- C. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- D. Install deep-seal traps on floor drains and other waste outlets, if indicated.

- E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- F. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

SECTION 22 31 00 - DOMESTIC WATER SOFTENERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Commercial water softeners.
 - 2. Chemicals.
 - 3. Water-testing sets.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water softeners.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 3. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Salt for Brine Tanks: Furnish in same form as and at least four times original load, but not less than 200 lb. Deliver on pallets according to the following:
 - a. Food-Grade Pellet Salt: In 40- or 50-lb packages.
 - 2. Store salt on raised platform where directed by owner. Do not store in contact with concrete floor.

1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended application.
- B. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.
- C. ASME Compliance for FRP Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, where indicated.
- D. UL Compliance: Fabricate and label water softeners to comply with UL 979, "Water Treatment Appliances."

1.08 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softeners that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures of mineral and brine tanks.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - d. Attrition loss of resin exceeding 3 percent per year.
 - e. Mineral washed out of system during service run or backwashing period.
 - f. Effluent turbidity greater and color darker than incoming water.
 - g. Fouling of underdrain system, gravel, and resin with turbidity or by dirt, rust, or scale from water softener or soft water, while operating according to manufacturer's written operating instructions.

2. Commercial Water Softeners, Warranty Period: From date of Substantial Completion.
 - a. Mineral Tanks: Five years.
 - b. Brine Tanks: 10 years.
 - c. Control Valve: One year(s).

1.10 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of water softener Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper water softener operation at rated capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
- B. Continuing Maintenance Proposal: From Installer to owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 PRODUCTS

2.01 COMMERCIAL WATER SOFTENERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Capital Water Softener.
 2. Hellenbrand Water Softener.
 3. Diamond H2O.
 4. Water Control Inc.
- B. Description: Factory-assembled, pressure-type water softener.
 1. Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects."
 2. Configuration: Single unit with one mineral tank and one brine tank.
 3. Mounting: On skids.
 4. Wetted Components: Suitable for water temperatures from 40 to at least 100 deg F.
 5. Mineral Tanks: FRP, pressure-vessel quality.
 - a. Construction: Non-ASME code.
 - b. Pressure Rating: 125 psig minimum.
 - c. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
 - d. Support Legs or Skirt: Constructed of structural steel, welded to tank.
 - e. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.

- f. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from nonmetallic pipe and fittings with individual, fine-slotted, nonclogging plastic strainers, and arranged for even flow distribution through resin bed.
 - g. Liner: PE, ABS, or other material suitable for potable water.
 - 6. Controls: Fully automatic; factory wired and factory mounted on unit.
 - a. Adjustable duration of various regeneration steps.
 - b. Push-button start and complete manual operation.
 - c. Microprocessor demand of various regeneration steps.
 - d. Includes means of manual operation of pilot-control valve if power fails.
 - 7. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:
 - a. Slow opening and closing, nonslam operation.
 - b. Diaphragm guiding on full perimeter from fully open to fully closed.
 - c. Isolated, dissimilar metals within valve.
 - d. Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
 - e. Valve for single mineral-tank unit with internal automatic bypass of raw water during regeneration.
 - f. Sampling cocks for soft water.
 - g. Special tools are not required for service.
 - 8. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressure; does not require field adjustments.
 - a. Demand-Initiated Control: Single mineral tank is equipped with automatic-reset-head water meter that electrically activates cycle controller to initiate regeneration at preset total in gallons. Head automatically resets to preset total in gallons for next service run.
 - 9. Brine Tank: Combination measuring and wet-salt storing system.
 - a. Tank and Cover Material: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
 - b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawal and freshwater refill.
 - c. Size: Large enough for at least four regenerations at full salting.
 - 10. Factory-Installed Accessories:
 - a. Piping, valves, tubing, and drains.
 - b. Sampling cocks.
 - c. Main-operating-valve position indicators.
 - d. Water meters.
- C. Capacities and Characteristics:
 - 1. Water Analysis: Base on actual field conditions of new potable well.
 - 2. Continuous Service Flow Rate: 10 gpm at 15-psig pressure drop.
 - 3. Peak Service Flow Rate: 15 gpm at 25-psig pressure drop.
 - 4. Number of Mineral Tanks: One.

- 5. Electrical Characteristics:
 - a. Volts: 120.
 - b. Phases: Single.
 - c. Hertz: 60.

2.02 CHEMICALS

- A. Mineral: High-capacity, sulfonated-polystyrene, ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.
 - 1. Exchange Capacity: 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.
- B. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are unacceptable.
 - 1. Form: Processed, food-grade salt pellets.

2.03 WATER-TESTING SETS

- A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

2.04 SOURCE QUALITY CONTROL

- A. Hydrostatically test mineral tanks before shipment to a minimum of one and one-half times the pressure rating.
- B. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 WATER SOFTENER INSTALLATION

- A. Equipment Mounting: Install commercial water softeners on concrete base.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 7. Anchor water softener and brine tanks to substrate.
- B. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.

- C. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.
- D. Install water-testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.02 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to equipment, allow space for service and maintenance of equipment.
- C. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank.
 - 1. Metal general-duty valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- D. Install valved bypass in water piping around water softeners.
 - 1. Metal general-duty valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 - 2. Water piping is specified in Section 221116 "Domestic Water Piping."
- E. Install drains as indirect wastes to spill into open drains or over floor drains.

3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Water softeners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

- B. Add water to brine tanks and fill with the following form of salt:
 - 1. Commercial Water Softeners: Processed, food-grade salt pellets.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain water softeners.

SECTION 22 33 00 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Commercial, electric, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.07 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: One years.

PART 2 PRODUCTS

2.01 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Water Heaters.
 - b. Bradford White Corporation.
 - c. Rheem Manufacturing Company.
 - d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - 2. Standard: UL 1453.
 - 3. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

- b. Pressure Rating: 150 psig.
- c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
- 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

B. Capacity and Characteristics:

- 1. Capacity: 6 gal..
- 2. Recovery: 6 gph at 100 deg F temperature rise.
- 3. Temperature Setting: 140 deg F.
- 4. Power Demand: 1500.
- 5. Heating Elements:
 - a. Number of Elements: One .
 - b. Kilowatts Each Element: 1,500.
 - c. Number of Stages: One.
- 6. Electrical Characteristics:
 - a. Volts: 208.
 - b. Phases: Single.
 - c. Hertz: 60.
 - d. Full-Load Amperes: 7.2.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

- A. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on domestic-water heater mounting bracket.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Anchor domestic-water heaters to substrate.
- B. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- C. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- D. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- E. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- F. Fill electric, domestic-water heaters with water.

3.02 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

3.05 DEMONSTRATION

- A. Train owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

SECTION 22 34 36.23 - COMMERCIAL, HIGH-EFFICIENCY, GAS DOMESTIC WATER HEATERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.
- B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.07 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: One year.
 - b. Compression Tanks: Five years.

PART 2 PRODUCTS

- A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Water Heaters.
 - b. Lochinvar Corporation.
 - c. State Industries.
 - 2. Standard: ANSI Z21.10.3/CSA 4.3.
 - 3. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
 - 4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - 5. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.

- d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
 - g. Temperature Control: Adjustable thermostat.
 - h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
6. Draft Hood: Power vented, sealed combustion.

B. Capacity and Characteristics:

- 1. Capacity: 60 gal.
- 2. Recovery: 138gph at 100 deg F temperature rise.
- 3. Temperature Setting: 140 deg F.
- 4. Fuel Gas Input: 120,000BTUH.
- 5. Gas Pressure Regulator:
 - a. Gas Pressure Required at Burner: 7" water column.
- 6. Electrical Characteristics:
 - a. Volts: 120.
 - b. Phase: Single.
 - c. Hertz: 60.
 - d. Full-Load Amperes: 6.2.
- 7. Minimum Vent and Intake Diameter: 3".

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AMTROL Inc.
 - b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - c. State Industries.
 - d. Taco, Inc.
- 2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

- 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
- 4. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 2 gal. minimum.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.
- C. Heat-Trap Fittings: ASHRAE 90.2.
- D. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- E. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.
- F. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- H. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 03.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 7. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
 - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 - 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Division 23.

- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- G. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Fill domestic-water heaters with water.
- I. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Division 23.
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
1. Water closets.
 2. Flushometer valves.
 3. Toilet seats.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities" about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 109-58, "Energy Policy Act of 2005," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, fittings, and other components that are compatible.
- G. Comply with the following applicable standards:
 - 1. Vitreous-China Fixtures: ASME A112.19.2/CSA B45.1.
 - 2. Water-Closet, Flushometer Tank Trim: ASME A112.19.5.
 - 3. Brass and Copper Supplies: ASME A112.18.1/CSA B125.1.
 - 4. Manual-Operation Flushometers: ASSE 1037.
 - 5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
 - 6. Off-Floor Fixture Supports: ASME A112.6.1M.
 - 7. Pipe Threads: ASME B1.20.1.
 - 8. Plastic Toilet Seats: ANSI Z124.5.

1.07 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fixture descriptions in the following articles include basis-of-design products that establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the architect/engineer and owner will be accepted:
1. Carriers and Supports Josam, Jay R. Smith, Wade.
 2. Flush Valves – Sloan, Zurn.
 3. Supplies and Stops , Chicago Faucets, Kohler, T & S Brass
 4. Water Closets American Standard, Kohler, Zurn.
 5. Water Closet Seats Bemis, Kohler

2.02 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

- A. Water Closets (WC-1 and WC-2): Floor mounted, bottom outlet, top spud.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Zurn Industries, LLC; Commercial Brass and Fixtures.
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard for WC-1 and ADA height for WC-2.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White.
 3. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
 4. Flushometer Valve: Sloan Optima 111-1.28, chrome plated, 24V direct wired, sensor operated.
 5. Toilet Seat: Bemis 1955SSFR.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Water-Closet Installation:
 - 1. Install level and plumb according to roughing-in drawings.
 - 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
 - 3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
 - 1. Install floor-mounted water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
- C. Flushometer-Valve Installation:
 - 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 - 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
 - 4. Install actuators in locations that are easy for people with disabilities to reach.
- D. Install toilet seats on water closets.
- E. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- F. Joint Sealing:
 - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to water-closet color.
 - 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by owner.

SECTION 22 42 13.16 - COMMERCIAL URINALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Urinals.
 - 2. Flushometer valves.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 PRODUCTS

2.01 WALL-HUNG URINALS

- A. Urinals UR-1: Wall hung, back outlet, washout, accessible.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Zurn Industries, LLC; Commercial Brass and Fixtures.
 - 2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Washout with extended shields.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: Water saving 0.125gpf.
 - f. Spud Size and Location: NPS 3/4, top.
 - g. Outlet Size and Location: NPS 2, back.
 - h. Color: White.
 - 3. Flushometer Valve: See "Urinal Flushometer Valves" Article.
 - 4. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2.
 - 5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.02 URINAL FLUSHOMETER VALVES

- A. Solenoid-Actuator, Diaphragm Flushometer Valves:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:
 - a. Zurn Industries, LLC; Commercial Brass and Fixtures.
 - 2. Standard: ASSE 1037.
 - 3. Minimum Pressure Rating: 125 psig.
 - 4. Features: Include integral check stop and backflow-prevention device.
 - 5. Material: Brass body with corrosion-resistant components.
 - 6. Panel Finish: Chrome plated.
 - 7. Style: Concealed.

8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
9. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Consumption: 0. per flush.
11. Minimum Inlet: NPS 3/4.
12. Minimum Outlet: NPS 3/4.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Urinal Installation:
 1. Install urinals level and plumb according to roughing-in drawings.
 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
 3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1. Refer to Architectural drawings for locations.
- B. Support Installation:
 1. Install supports, affixed to building substrate, for wall-hung urinals.
 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
 3. Use carriers without waste fitting for urinals with tubular waste piping.
 4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
- C. Flushometer-Valve Installation:
 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- D. Wall Flange and Escutcheon Installation:
 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
 2. Install deep-pattern escutcheons if required to conceal protruding fittings.

- E. Joint Sealing:
 - 1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to urinal color.
 - 3. Comply with sealant requirements specified in Section 07.

3.03 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.04 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by owner.

SECTION 22 42 16.13 - COMMERCIAL LAVATORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Lavatories.
 - 2. Faucets.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. Include the following:
 - a. Servicing and adjustments of automatic faucets.

PART 2 PRODUCTS

- A. Lavatory L-1: Oval, self rimming, enameled, cast iron, counter mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kohler Co.
 - b. Zurn Industries, LLC; Commercial Brass and Fixtures.
 - 2. Fixture:
 - a. Standard: ASME A112.19.1/CSA B45.2.
 - b. Type: Self-rimming for above-counter mounting.
 - c. Nominal Size: Oval, 19-1/4"x16-1/4".
 - d. Faucet-Hole Punching: One hole.
 - e. Faucet-Hole Location: Top.
 - f. Color: White.
 - g. Mounting Material: Sealant.
 - 3. Faucet: "Solid-Brass, Automatically Operated Lavatory Faucets" Article.

2.02 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Automatic-type, hard-wired, electronic-sensor-operated, mixing, solid-brass valve.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. Moen Incorporated.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC; Commercial Brass and Fixtures.
 - 2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
 - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 - 5. Body Type: Single hole.
 - 6. Body Material: Commercial, solid brass.
 - 7. Finish: Polished chrome plate.
 - 8. Maximum Flow Rate: 0.5 gpm.
 - 9. Mounting Type: Deck, concealed.
 - 10. Spout: Rigid type.
 - 11. Spout Outlet: Aerator.
 - 12. Drain: Not part of faucet.

2.03 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 - 1. NPS 3/8.
 - 2. Chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.04 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2 by NPS 1-1/4.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- C. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07.
- D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.

Do not allow use of lavatories for temporary facilities unless approved in writing by owner.

SECTION 22 42 16.14 - ENGINEERED LAVATORY DECKS AND FAUCETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- 1. Factory-assembled engineered quartz commercial lavatory deck systems with single-point utility connections.
- 2. Commercial lavatory faucets.

1.02 REFERENCES:

- A. American Society of Sanitary Engineering (ASSE):
 - 1. ASSE 1070 - Water Temperature Limiting Devices.
- B. American National Standards Institute (ANSI):
 - 1. ANSI Z 124.3 - Plastic Lavatories.
 - 2. ANSI Z 124.6 - Plastic Sinks.
 - 3. ANSI/ICPA SS-1-2001 - Performance Standard for Solid Surface Materials.
- C. American Society of Mechanical Engineers (ASME):
 - 1. ASME A112.18.1 Plumbing Supply Fittings.
- D. ASTM International (ASTM):
 - 1. ASTM C 170 - Standard Test Method for Compressive Strength of Dimension Stone.
 - 2. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
 - 3. ASTM D 785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.

4. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 5. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. Canadian Standards Association (CSA):
1. CSA B125 - (See ASME A112.18.1 - Plumbing Fixture Fittings).
- F. International Association of Plumbing and Mechanical Officials (IAPMO):
1. Universal Plumbing Code (cUPC both U.S. and Canada).
- G. International Code Council (ICC):
1. ICC/ANSI A117.1 – Accessible and Usable Buildings and Facilities.
- H. National Fire Protection Association (NFPA):
1. NFPA 70 – National Electrical Code.
- I. Underwriters Laboratories, Inc. (UL):
1. UL 723 - Test For Surface Burning Characteristics of Building Materials.
 2. UL 1951 - Electric Plumbing Accessories.
- J. US Federal Government:
1. Public Law 102-486 - Energy Policy Act. 1992 (EPACT).
 2. U.S. Architectural & Transportation Barriers Compliance Board. Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).

1.03 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets, installation instructions, and maintenance recommendations.
- B. Product Test Reports: Indicating compliance of products with requirements, from a qualified independent testing agency, when requested by architect.
- C. Shop Drawings: Prepared by manufacturer. Include rough-in requirements and power, signal, and control wiring diagrams. Provide mounting requirements and rough-in dimensions. Include details of electrical and mechanical operating parts.

1.04 INFORMATION SUBMITTALS

- A. Sample warranty.
- B. Manufacturer's Certificates.
- C. Indoor environmental quality certificates.

1.05 MAINTENANCE SUBMITTALS

- A. Furnish indicated spare parts that are packaged with identifying labels listing associated products.
- B. Operation, maintenance and cleaning data.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in the manufacture of plumbing fixtures. Manufacturers seeking approval must submit the following:
 - 1. Product data, including test data from qualified independent testing agency indicating compliance with requirements.
 - 2. Samples of each component of product specified.
 - 3. List of successful installations of similar products available for evaluation by architect.
 - 4. Submit substitution request not less than 15 days prior to bid date.
- B. Source Limitations: Obtain each type of plumbing fixture and compatible accessories through one source from a single approved manufacturer.
- C. Accessibility Requirements: Comply with requirements of ADA/ABA and with requirements of authorities having jurisdiction.
- D. Water Flow and Consumption Requirements: Comply with EPACT.
- E. Drinking Water Standard: Comply with NSF 61.
- F. Electrical Components: Listed and labeled per NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.07 COORDINATION

- A. Field Measurements: Verify locations of lavatory decks and adjacent walls prior to fabrication.

1.08 WARRANTY

- A. Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace commercial lavatory decks that fail in materials or workmanship.
 - 1. Solid surface material: 3 years.
 - 2. Faucets: 1 year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1. Basis-of-Design Product: Subject to compliance with requirements, provide commercial lavatory decks and faucets manufactured by Sloan Valve Company. Submit requests for substitution according to Instructions to Bidders and Division 01 General Requirements.

2.02 MATERIALS

- A. Solid Surface Material: Where indicated as constructed of solid surface material, fabricate plumbing fixtures from thermoset acrylic modified polyester resin certified by approved independent testing agency as complying with ANSI/ICPA SS-1, ANSI Z124.3, and ANSI Z124.6, with the following minimum properties:
 1. Basis of Design Product: Sloan, SloanStone.
 2. Thickness: 1/2 inch, minimum.

2.03 LAVATORY DECKS, MULTIPLE STATION (L-2 PUBLIC RESTROOMS)

1. ADA/ABA Compliant Wall-Mounted, Multiple-Station Lavatory Fixture L-2: With integral bowls, molded water overflow, drain, strainer, and tailpiece. Basis of Design Manufacturer/Model: Sloan, SloanStone ELS-42600, Willoughby Industries, AquaWave .
2. Material: Solid surface material.
3. Configuration: 2 station deck.
4. Trap Cover: Stainless steel.
5. Mounting: Stainless steel mounting brackets.
6. Overall Unit Size: 54x21.
7. Deck Colors: As selected by architect from manufacturer's full line.
8. Faucets: Sensor operated, Sloan, Model ETF-600, Chicago Faucets, with below deck mixer, above ceiling box mounted transformer.
9. Water Supply: Below deck mixing valve assembly, with single point rough-in for unit.
10. Waste Hookup: Single point rough-in for unit.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions and verify opening measurements prior to commencing installation. Proceed with installation once conditions meet requirements.

3.02 INSTALLATION

- A. Assemble fixtures and associated fittings and trim according to manufacturer's instructions.
- B. Install fixture supports attached to building structure for fixtures requiring supports.

- C. Install fixtures onto waste-fitting seals or flanges and attach to supports or building structure.
- D. Install fixtures level, plumb, and firmly in place according to manufacturer's rough-in drawings.
- E. Single-Point Connections:
 - 1. Install water supply piping to unit. Provide stop on each supply in readily-serviced location. Fasten supply piping to supports or substrate.
 - 2. Install trap and waste piping to unit.
- F. Install escutcheons at exposed piping penetrations in finished locations.
- G. Seal joints between fixtures and walls, floors, and countertops with joint sealant specified in Division 07 Section.

3.03 CLEANING AND PROTECTION

- A. Repair or replace defective work, including damaged fixtures and components.
- B. Clean unit surfaces, test fixtures, and leave in ready-to-use condition.
- C. Turn over keys, tools, maintenance instructions, and maintenance stock to owner.
- D. Protect units with water-resistant temporary covering. Do not allow temporary use of plumbing fixtures unless approved in writing by architect. Remove protection at Substantial Completion and dispose.

3.04 TESTING AND ADJUSTING

- A. Set field-adjustable temperature set points of temperature-actuated water mixing valves. Adjust set point within allowable temperature range.
- B. Test and adjust installation.
- C. Remove and replace malfunctioning thermostatic mixing valves and retest.

SECTION 22 42 16.16 - COMMERCIAL SINKS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Service basins.
 - 2. Utility sinks.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
 - 2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted sinks.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sinks to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 PRODUCTS

2.01 SERVICE BASINS

- A. Service Basins: Terrazzo, floor mounted.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Acorn Engineering Company.
 - b. Crane Plumbing, L.L.C.
 - c. Florestone Products Co., Inc.
 - d. Stern-Williams Co., Inc.
 - e. Fiat.
 - 2. Fixture:
 - a. Standard: IAPMO PS 99.
 - b. Shape: Rectangular.
 - c. Nominal Size: 24 by 24 inches.
 - d. Height: 12 inches.
 - e. Rim Guard: On all top surfaces.
 - f. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.
4. Faucet: Chicago, Model 897-CP.

2.02 UTILITY SINKS

A. Utility Sinks: Stainless steel, counter mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Advance Tabco.
 - b. Just Manufacturing.
2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Type: Ledge back.
 - c. Number of Compartments: One.
 - d. Overall Dimensions: 17x22.
 - e. Metal Thickness: 18 gauge, 304 stainless steel.
 - f. Compartment:
 - 1) Dimensions: 13-1/2"x16x7-1/8" deep.
 - 2) Drain: NPS 1-1/2 tailpiece with basket strainer stopper.
 - 3) Drain Location: Centered in compartment.
3. Faucet(s): Kohler K15171-F or approved equal by American Standard, Delta or Moen..
 - a. Number Required: One.
 - b. Mounting: On ledge.
4. Supply Fittings:
 - a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Supplies: Ball Valve.
 - 1) Operation: Lever.
 - 2) Risers: NPS 1/2, chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided or corrugated stainless-steel flexible hose.
5. Waste Fittings:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Trap(s):
 - 1) Size: NPS 1-1/2.
 - 2) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall, cleanout plug; and stainless-steel wall flange.
6. Mounting: On counter with sealant.

2.03 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.

- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Set floor-mounted sinks in leveling bed of cement grout.
- C. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
- E. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by owner.

SECTION 22 47 16 - PRESSURE WATER COOLERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes pressure water coolers and related components.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of pressure water cooler.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 1 of each.

PART 2 PRODUCTS

2.01 PRESSURE WATER COOLERS

- A. Pressure Water Coolers (EWC-1): Wall mounted wheelchair accessible.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Halsey Taylor.
 - b. Haws Corporation.
 - c. Tri Palm International, LLC; Oasis Brand.
 - d. Tri Palm International, LLC; Sunroc Brand.
 - 2. Cabinet: Single, vinyl-covered steel with stainless-steel top and bottle filling station.
 - 3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
 - 4. Control: Push bar.
 - 5. Drain: Grid with NPS 1-1/4 tailpiece.
 - 6. Supply: NPS 3/8 with shutoff valve.
 - 7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
 - 8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - 9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 10. Capacities and Characteristics:
 - a. Cooled Water: 8 gph.
 - b. Ambient-Air Temperature: 90 deg F.
 - c. Inlet-Water Temperature: 80 deg F.
 - d. Cooled-Water Temperature: 50 deg F.
 - e. Electrical Characteristics:
 - 1) Volts: 120-V ac.
 - 2) Phase: Single.
 - 3) Hertz: 60.
 - 4) Full-Load Amperes: 4.2.
 - 11. Support: ASME A112.6.1M, Type I water-cooler carrier.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- C. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers to mounting frames.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings.
- G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

- C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust pressure water-cooler temperature settings.

3.05 CLEANING

- A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by owner.

73. Rest Area 31 Building Heating and Ventilation, Item SPV.0105.04.

A Description

This work includes the mechanical construction required to complete the rest area buildings according to the applicable plans, the 'General Requirements for Building Construction', and the technical specifications.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Rest Area No. 31 Building Heating and Ventilation as a single lump sum unit complete in place and accepted.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.04	Rest Area 31 Building Heating and Ventilation	LS

Payment is full compensation for furnishing all materials and equipment; and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

INDEX OF MECHANICAL SPECIFICATIONS

23 05 00 Common Work Results for HVAC
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 29 Hangers and Supports for HVAC Piping and Equipment
23 05 48 Vibration and Seismic Controls for HVAC
23 05 53 Identification for HVAC Piping and Equipment
23 05 93 Testing, Adjusting, and Balancing for HVAC
23 07 13 Duct Insulation
23 07 19 HVAC Piping Insulation
23 09 33 Electric and Electronic Control System for HVAC
23 11 23 Facility Natural-Gas Piping
23 23 00 Refrigerant Piping
23 31 13 Metal Ducts
23 33 00 Air Duct Accessories
23 34 23 HVAC Power Ventilators
23 37 13 Diffusers, Registers, and Grilles
23 54 16 Gas-Fired Furnaces
23 55 33 Fuel-Fired Unit Heaters
23 63 13 Air-Cooled Refrigerant Condensers
23 72 00 Air-To-Air Energy Recovery Equipment
23 82 39 Electric Heating Units

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
 2. Transition fittings.
 3. Dielectric fittings.
 4. Mechanical sleeve seals.
 5. Sleeves.
 6. Escutcheons.
 7. Grout.
 8. Equipment installation requirements common to equipment sections.
 9. Painting and finishing.
 10. Concrete bases.
 11. Supports and anchorages.

1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.
 - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.

1.05 QUALITY ASSURANCE

- A. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- E. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- F. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.04 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Manufacturers:
 - a. Central Plastics Company.
 - b. Eclipse, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Manufacturers:
 - a. Central Plastics Company.
 - b. Epco Sales, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.05 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.06 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.07 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.08 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.

- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw .
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw .
 - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- H. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- J. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- K. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- D. Install equipment to allow right-of-way for piping installed at required slope.

3.05 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.06 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi , 28-day compressive-strength concrete and reinforcement as specified in Division 3.

3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.08 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

1.04 DEFINITIONS

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

PART 2 PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.

- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 EXECUTION (NOT APPLICABLE)

SECTION 23 05 29 - MECHANICAL HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following hangers and supports for mechanical system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.
 - 6. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 5 Section for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 23 Section "Mechanical Vibration" for vibration isolation devices.
 - 3. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Pipe positioning systems.

1.06 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 - 5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Grinnell Corp.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.03 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.04 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.05 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless] steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.06 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 - 1. C & S Mfg. Corp.
 - 2. HOLDRITE Corp.; Hubbard Enterprises.
 - 3. Samco Stamping, Inc.

2.07 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.08 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 5. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 - 9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 - 10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 - 11. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 - 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 13. .

- G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- I. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

- J. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 15 Section "Plumbing Fixtures" for plumbing fixtures.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - 5. Insert Material: Length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Elastomeric isolation pads and mounts.
 - 2. Elastomeric hangers.
 - 3. Spring hangers.
 - 4. Spring hangers with vertical-limit stops.

1.03 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.04 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. Ace Mounting Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. B-Line Systems, Inc.
 - 4. California Dynamics Corp.
 - 5. Isolation Technology, Inc.
 - 6. Kinetics Noise Control, Inc.
 - 7. Mason Industries, Inc.
 - 8. Vibration Eliminator Co., Inc.
 - 9. Vibration Isolation Co., Inc.
 - 10. Vibration Mountings and Controls/Korfund.
- B. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Natural rubber.
 - 2. Durometer Rating: 45 to 70.
 - 3. Number of Layers: 2.

- C. Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - 1. Durometer Rating: 45 to 65.
- D. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- E. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
 - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- F. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
 - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

2.03 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.

- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- B. Install resilient bolt isolation washers on equipment anchor bolts.

3.03 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Perform the following field quality-control testing:
 - 1. Isolator deflection.

3.04 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust active height of spring isolators.
- E. Torque anchor bolts according to equipment manufacturer's written recommendations.

3.05 CLEANING

- A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 1 Section.

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment markers.
 - 2. Pipe markers.
 - 3. Stencils.
 - 4. Valve tags.
 - 5. Valve schedules.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve numbering scheme.
- C. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.05 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data: Name and plan number.
 - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

2.02 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
 - 4. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
 - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.

2.03 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
 - 1. Stencil Material: Metal or fiberboard.
 - 2. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

2.04 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by owner. Provide 5/32-inch hole for fastener.
 - 1. Material: 0.032-inch- thick brass.
 - 2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.05 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
 - 2. Frame: Extruded aluminum.
 - 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

PART 3 EXECUTION

3.01 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.02 EQUIPMENT IDENTIFICATION

- A. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - e. Fans, blowers, primary balancing dampers, and mixing boxes.
- B. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

3.03 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles on each piping system.
1. Identification Paint: Use for contrasting background.
 2. Stencil Paint: Use for pipe marking.

- C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
 - 3. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 4. Near major equipment items and other points of origination and termination.
 - 5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 6. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.04 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
 - 1. Valve-Tag Size and Shape:
 - a. Gas: 1-1/2 inches, round.
 - 2. Valve-Tag Color:
 - a. Gas: Natural.
 - 3. Letter Color:
 - a. Gas: Black.

3.05 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

3.06 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.07 CLEANING

- A. Clean faces of mechanical identification devices.

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems: Constant-volume air systems.
 - 2. Space pressurization testing and adjusting.
 - 3. Vibration measuring.
 - 4. Sound level measuring.
 - 5. Indoor-air quality measuring.
 - 6. Verifying that automatic control devices are functioning properly.
 - 7. Reporting results of activities and procedures specified in this Section.

1.03 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Balancing Devices: All installed devices necessary to achieve proper balancing of the system such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers.
- D. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- E. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- F. NC: Noise criteria.
- G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- H. RC: Room criteria.
- I. Report Forms: Test data sheets for recording test data in logical order.

- J. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- K. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- L. TAB: Testing, adjusting, and balancing.
- M. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- N. Test: A procedure to determine quantitative performance of systems or equipment.
- O. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.04 SUBMITTALS

- A. Qualification Data: Within 45 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 90 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Sample Report Forms: Submit two sets of sample TAB report forms.
- F. Warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. TAB Conference: Meet with owner's and architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. The Contract Documents examination report.
 - c. TAB plan.
 - d. Work schedule and Project-site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.06 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.07 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the

Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Verify that balancing devices are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
 - 2. The TAB Firm shall review the contract documents and the mechanical contractor's shop drawings to identify any additional balancing devices that are necessary to achieve a balanced system but not shown on the drawings. Furnish and install those additional balancing devices necessary to achieve a balanced system. Coordinate with the mechanical contractor to properly schedule this work. Failure to coordinate installation of these devices with the mechanical contractor will result in absorbing all costs associated with work of other trades that is affected by modification of building components and systems. All balancing devices and installations shall comply with other Division 23 sections.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings

of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine equipment for installation and for properly operating safety interlocks and controls.
- M. Examine automatic temperature system components to verify the following:
 - 1. Dampers and other controlled devices are operated by the intended controller.
 - 2. Dampers are in the position indicated by the controller.
 - 3. Integrity of dampers for free and full operation and for tightness of fully closed and fully open positions. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 4. Sensors are located to sense only the intended conditions.
 - 5. Sequence of operation for control modes is according to the Contract Documents.
 - 6. Controller set points are set at indicated values.
 - 7. Interlocked systems are operating.
 - 8. Changeover from heating to cooling mode occurs according to indicated values.
- N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance dampers are open.
 - 5. Isolating and balancing valves are open and control valves are operational.
 - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

- D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling unit components.
- K. Check for proper sealing of air duct system.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving heat recovery equipment under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Obtain approval from architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
 - C. Measure terminal outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
 - D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer, model, and serial numbers.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.07 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Refrigerant Coils: Measure the following data for each coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.
 - 5. Refrigerant suction pressure and temperature.

3.09 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.10 PROCEDURES FOR SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

- A. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.
- B. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.
- C. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.
 - 1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.

2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
 3. Test room pressurization first, then zones, and finish with building pressurization.
- D. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.
- E. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.
- F. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.11 PROCEDURES FOR VIBRATION MEASUREMENTS

- A. Use a vibration meter meeting the following criteria:
1. Solid-state circuitry with a piezoelectric accelerometer.
 2. Velocity range of 0.1 to 10 inches per second.
 3. Displacement range of 1 to 100 mils.
 4. Frequency range of at least 0 to 1000 Hz.
 5. Capable of filtering unwanted frequencies.
- B. Calibrate the vibration meter before each day of testing.
1. Use a calibrator provided with the vibration meter.
 2. Follow vibration meter and calibrator manufacturer's calibration procedures.
- C. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.
1. Turn off equipment in the building that might interfere with testing.
 2. Clear the space of people.
- D. Perform vibration measurements after air and water balancing and equipment testing is complete.
- E. Clean equipment surfaces in contact with the vibration transducer.
- F. Position the vibration transducer according to manufacturer's written instructions and to avoid interference with the operation of the equipment being tested.
- G. Measure and record vibration on rotating equipment over 3 hp.
- H. Measure and record equipment vibration, bearing vibration, equipment base vibration, and building structure vibration. Record velocity and displacement readings in the horizontal, vertical, and axial planes.

1. Fans and HVAC Equipment with Fans:
 - a. Fan Bearing: Drive end and opposite end.
 - b. Motor Bearing: Drive end and opposite end.
 - c. Equipment Casing: Top and side.
 - d. Equipment Base: Top and side.
 - e. Building: Floor.
 - f. Ductwork: To and from equipment after flexible connections.
 - g. Piping: To and from equipment after flexible connections.
 2. HVAC Equipment with Compressors:
 - a. Compressor Bearing: Drive end and opposite end.
 - b. Motor Bearing: Drive end and opposite end.
 - c. Equipment Casing: Top and side.
 - d. Equipment Base: Top and side.
 - e. Building: Floor.
 - f. Piping: To and from equipment after flexible connections.
- I. For equipment with vibration isolation, take floor measurements with the vibration isolation blocked solid to the floor and with the vibration isolation floating. Calculate and report the differences.
- J. Inspect, measure, and record vibration isolation.
1. Verify that vibration isolation is installed in the required locations.
 2. Verify that installation is level and plumb.
 3. Verify that isolators are properly anchored.
 4. For spring isolators, measure the compressed spring height, the spring OD, and the travel-to-solid distance.
 5. Measure the operating clearance between each inertia base and the floor or concrete base below. Verify that there is unobstructed clearance between the bottom of the inertia base and the floor.

3.12 PROCEDURES FOR SOUND-LEVEL MEASUREMENTS

- A. Perform sound-pressure-level measurements with an octave-band analyzer complying with ANSI S1.4 for Type 1 sound-level meters and ANSI S1.11 for octave-band filters. Comply with requirements in ANSI S1.13, unless otherwise indicated.
- B. Calibrate sound meters before each day of testing. Use a calibrator provided with the sound meter complying with ANSI S1.40 and that has NIST certification.
- C. Use a microphone that is suitable for the type of sound levels measured. For areas where air velocities exceed 100 fpm, use a windscreen on the microphone.
- D. Perform sound-level testing after air and water balancing and equipment testing are complete.
- E. Close windows and doors to the space.

- F. Perform measurements when the space is not occupied and when the occupant noise level from other spaces in the building and outside are at a minimum.
- G. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.
- H. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, and other large surface capable of altering the measurements.
- I. Take sound measurements in dBA and in each of the 8 unweighted octave bands in the frequency range of 63 to 8000 Hz.
- J. Take sound measurements with the HVAC systems off to establish the background sound levels and take sound measurements with the HVAC systems operating.
- 1. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.
- K. Perform sound testing at 2 locations on Project for each of the following space types. For each space type tested, select a measurement location that has the greatest sound level. If testing multiple locations for each space type, select at least one location that is near and at least one location that is remote from the predominant sound source.
 - 1. Private office.

3.13 PROCEDURES FOR INDOOR-AIR QUALITY MEASUREMENTS

- A. After air balancing is complete and with HVAC systems operating at indicated conditions, perform indoor-air quality testing.
- B. Observe and record the following conditions for each HVAC system:
 - 1. The distance between the outside-air intake and the closest exhaust fan discharge, cooling tower, flue termination, or vent termination.
 - 2. Specified filters are installed. Check for leakage around filters.
 - 3. Cooling coil drain pans have a positive slope to drain.
 - 4. Cooling coil condensate drain trap maintains an air seal.
 - 5. Evidence of water damage.
 - 6. Insulation in contact with the supply, return, and outside air is dry and clean.
- C. Measure and record indoor conditions served by each HVAC system. Make measurements at multiple locations served by the system if required to satisfy the following:
 - 1. Most remote area.
 - 2. One location per floor.
 - 3. One location for every 5000 sq. ft..

- D. Measure and record the following indoor conditions for each location two times at two-hour intervals, and according to ASHRAE 113:
 - 1. Temperature.
 - 2. Relative humidity.
 - 3. Air velocity.
 - 4. Concentration of carbon dioxide (ppm).
 - 5. Concentration of carbon monoxide (ppm).
 - 6. Nitrogen oxides (ppm).
 - 7. Formaldehyde (ppm).

3.14 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.

3.16 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.17 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer, type size, and fittings.
 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Balancing stations.
 4. Position of balancing devices.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Number of filters, type, and size.
 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.

- f. Cooling coil static-pressure differential in inches wg.
- g. Outside airflow in cfm.
- h. Return airflow in cfm.
- i. Outside-air damper position.
- j. Return-air damper position.

G. Apparatus-Coil Test Reports:

- 1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
- 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outside-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Refrigerant expansion valve and refrigerant types.
 - i. Refrigerant suction pressure in psig.
 - j. Refrigerant suction temperature in deg F.

H. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

- 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btuh.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.
 - h. Low-fire fuel input in Btuh.
 - i. High-fire fuel input in Btuh.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btuh.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btuh.

- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.

- J. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 1. Report Data:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.

- h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- K. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Unit make and model number.
 - d. Compressor make.
 - e. Compressor model and serial numbers.
 - f. Refrigerant weight in lb.
 - g. Low ambient temperature cutoff in deg F.
 - 2. Test Data (Indicated and Actual Values):
 - a. Inlet-duct static pressure in inches wg.
 - b. Outlet-duct static pressure in inches wg.
 - c. Entering-air, dry-bulb temperature in deg F.
 - d. Leaving-air, dry-bulb temperature in deg F.
 - e. Control settings.
 - f. Unloader set points.
 - g. Low-pressure-cutout set point in psig.
 - h. High-pressure-cutout set point in psig.
 - i. Suction pressure in psig.
 - j. Suction temperature in deg F.
 - k. Condenser refrigerant pressure in psig.
 - l. Condenser refrigerant temperature in deg F.
 - m. Oil pressure in psig.
 - n. Oil temperature in deg F.
 - o. Voltage at each connection.
 - p. Amperage for each phase.
 - q. Kilowatt input.
 - r. Crankcase heater kilowatt.
 - s. Number of fans.
 - t. Condenser fan rpm.
 - u. Condenser fan airflow rate in cfm.
 - v. Condenser fan motor make, frame size, rpm, and horsepower.
 - w. Condenser fan motor voltage at each connection.
 - x. Condenser fan motor amperage for each phase.
- L. Air-to-Air Heat-Recovery Unit Reports:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.

- c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
- 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
- 3. If fans are an integral part of the unit, include the following for each fan:
 - a. Make and type.
 - b. Arrangement and size.
 - c. Sheave make, size in inches, and bore.
 - d. Sheave dimensions, center-to-center, and amount of adjustments in inches.
- 4. Test Data (Indicated and Actual Values):
 - a. Total exhaust airflow rate in cfm.
 - b. Purge exhaust airflow rate in cfm.
 - c. Outside airflow rate in cfm.
 - d. Total exhaust fan static pressure in inches wg.
 - e. Total outside-air fan static pressure in inches wg.
 - f. Pressure drop on each side of recovery wheel in inches wg.
 - g. Exhaust air temperature entering in deg F.
 - h. Exhaust air temperature leaving in deg F.
 - i. Outside-air temperature entering in deg F.
 - j. Outside-air temperature leaving in deg F.
 - k. Calculate sensible and total heat capacity of each airstream in MBh.
- M. Vibration Measurement Reports:
 - 1. Date and time of test.
 - 2. Vibration meter manufacturer, model number, and serial number.
 - 3. Equipment designation, location, equipment, speed, motor speed, and motor horsepower.
 - 4. Diagram of equipment showing the vibration measurement locations.
 - 5. Measurement readings for each measurement location.
 - 6. Calculate isolator efficiency using measurements taken.
 - 7. Description of predominant vibration source.
- N. Sound Measurement Reports: Record sound measurements on octave band and dBA test forms and on an NC or RC chart indicating the decibel level measured in each frequency band for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms:
 - 1. Date and time of test. Record each tested location on its own NC curve.
 - 2. Sound meter manufacturer, model number, and serial number.

3. Space location within the building including floor level and room number.
 4. Diagram or color photograph of the space showing the measurement location.
 5. Time weighting of measurements, either fast or slow.
 6. Description of the measured sound: steady, transient, or tonal.
 7. Description of predominant sound source.
- O. Indoor-Air Quality Measurement Reports for Each HVAC System:
1. HVAC system designation.
 2. Date and time of test.
 3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
 4. Room number or similar description for each location.
 5. Measurements at each location.
 6. Observed deficiencies.
- P. Instrument Calibration Reports:
1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.18 INSPECTIONS

- A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
 2. Randomly check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Measure sound levels at two locations.
 - e. Measure space pressure of at least 10 percent of locations.
 - f. Verify that balancing devices are marked with final balance position.
 - g. Note deviations to the Contract Documents in the Final Report.
- B. Final Inspection:
1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by architect.
 2. TAB firm test and balance engineer shall conduct the inspection in the presence of architect.

3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, owner shall contract the services of another TAB firm to complete the testing and balancing according to the Contract Documents and deduct the cost of the services from the final payment.

3.19 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes semirigid and flexible duct, and plenum insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 1. Division 23 Section "HVAC Piping Insulation" for insulation for piping systems.
 2. Division 23 Section "Metal Ducts" for duct liner.

1.03 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

1.04 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

1.07 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Johns Manville
 - c. Knauf FiberGlass GmbH.
 - d. Owens-Corning Fiberglas Corp.

2.02 INSULATION MATERIALS

- A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

2.03 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..
 - 1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
 - 2. Galvanized Steel: 0.005 inch thick.
 - 3. Aluminum: 0.007 inch thick.
 - 4. Brass: 0.010 inch thick.
 - 5. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.
- D. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
 - 1. Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.

2.04 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
 - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 - 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
- O. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

3.04 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - 4. Impale insulation over anchors and attach speed washers.
 - 5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 - 7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.

8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
 10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.
- B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Space anchor pins as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
 8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.05 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket.
- B. Color: Final color as selected by architect. Vary first and second coats to allow visual inspection of the completed Work.

3.06 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
- C. Insulate the following plenums and duct systems:
 - 1. Indoor concealed supply- and outside-air ductwork.
 - 2. Indoor exposed supply- and outside-air ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Metal ducts with duct liner.
 - 2. Factory-insulated flexible ducts.
 - 3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 - 4. Flexible connectors.
 - 5. Vibration-control devices.
 - 6. Testing agency labels and stamps.
 - 7. Nameplates and data plates.
 - 8. Access panels and doors in air-distribution systems.

3.07 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Supply-air ducts, concealed.
 - 1. Material: Mineral-fiber board or mineral-fiber blanket .
 - 2. Thickness: 1-1/2 inches.
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Glass cloth.
 - 5. Vapor Retarder Required: Yes.
- B. Service: Outside-air ducts, concealed.
 - 1. Material: Mineral-fiber board or mineral-fiber blanket .
 - 2. Thickness: 1-1/2 inches each.
 - 3. Number of Layers: Two.
 - 4. Field-Applied Jacket: Glass cloth.
 - 5. Vapor Retarder Required: Yes.

- C. Service: Round, supply-air ducts, exposed in occupied spaces.
 - 1. Ducts shall be double-wall insulated ducts as specified in section 233113 "Metal Ducts".
- D. Service: Round, supply-air ducts, exposed in unoccupied spaces.
 - 1. Material: Mineral-fiber blanket .
 - 2. Thickness: 1-1/2 inches.
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Glass cloth.
 - 5. Vapor Retarder Required: Yes.
- E. Service: Outside-air ducts, exposed.
 - 1. Material: Mineral-fiber board .
 - 2. Thickness: 2 inches.
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Glass cloth.
 - 5. Vapor Retarder Required: Yes.

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Refrigerant suction and hot-gas piping.
- B. Related Sections:
 - 1. Section 23 07 13 "Duct Insulation."

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Volatile Organic Compound Limits: Adhesives and sealants for interior use shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. Protect insulation against dirt, water, chemical and mechanical damage before, during and after installation. Do not install damaged insulation; remove it from the project site.

1.07 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

1.08 COORDINATE CLEARANCE REQUIREMENTS WITH PIPING INSTALLER FOR PIPING INSULATION APPLICATION. SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. VOC limit for indoor applications:50 g/L.

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. VOC limit for indoor applications:50 g/L.

- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 - 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - 4. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: 60 percent by volume and 66 percent by weight.
 - 4. Color: White.

2.04 SEALANTS

- A. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.
 - 5. VOC limit for indoor applications: 420 g/L.

2.05 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.06 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: Color as selected by architect.
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.07 TAPES

- A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Width: 2 inches.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.

2.08 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal].
 - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
 - 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Wire: 0.062-inch soft-annealed, stainless steel or Monel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. .

3.04 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to

- a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.08 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by architect. Vary first and second coats to allow visual inspection of the completed Work.

3.09 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.

3.11 PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping and Flexible Tubing:
 - 1. Insulation Material: Mineral fiber or flexible elastomeric.
 - 2. Insulation Thickness: 1 inch minimum.
 - 3. Factory Applied Jacket: ASJ-SSL on mineral fiber.
 - 4. Field-Applied Jacket: PVC on exterior piping and exposed piping in mechanical rooms or within 10 feet of floor in occupied spaces.
 - 5. Vapor Barrier Required: No

SECTION 23 09 33 - HVAC ELECTRIC CONTROL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of Electric HVAC control systems work required by this section is indicated on drawings and schedules, and by requirements of this section.
 - 1. Control system components
 - 2. Control sequences are specified in this section.
- B. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections:
 - 1. Control wiring between field-installed controls, indicating devices, and unit control panels. All control wiring to be routed in conduit and shall comply with Division 26 requirements. Coordinate with electrical contractor.
 - 2. Power supply wiring for power source to power connection on controls and/or unit control panels unless shown on electrical drawings.
 - 3. Interlock wiring between electrically operated equipment units; and between equipment and field-installed control devices unless shown on electrical drawings.

1.02 RELATED SECTIONS

- A. Control dampers and damper actuators are specified in Section 23 33 00 – Duct Accessories.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of electric control equipment, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms specializing and experienced in electric control system installations for not less than 5 years.
- C. Codes and Standards:
 - 1. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.
 - 2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.
 - 3. NFPA Compliance: Comply with NFA 90A "Standard for the installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

1.04 SUBMITTALS

- A. Product Data
 - 1. Submit manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, and including installation instructions and start-up instructions.
- B. Shop Drawings
 - 1. Submit shop drawings for each electric control system, containing the following information:
 - a. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves, and control devices.
 - b. Label each control device with setting or adjustable range of control.
 - c. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
 - d. Provide details of faces of control panels, including controls, instruments, and labeling.
 - e. Include verbal description of sequence of operation.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory-shipping cartons for each piece of equipment, and control device. Maintain cartons through shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Vendors: Subject to compliance with requirements, provide HVAC Controls as needed utilizing components provided by industry standard vendors such as but not limited to the following:
 - 1. Siemens
 - 2. Honeywell
 - 3. Johnson Controls
 - 4. Landis Staefa
 - 5. Or Equal

2.02 MATERIALS AND EQUIPMENT

- A. General
 - 1. Provide electric control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, clocks, sensors, controllers, and other components as required for a complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer. Provide electric control systems with following functional and construction features as indicated. Control contractor's option to utilize stand alone DDC components when necessary.
- B. Remote Bulb Thermostats: Provide remote bulb thermostats of on off, or modulating type, or reverse acting as required by sequence of operation. Provide liquid filled units designed to compensate for changes in ambient temperature at instrument case. Provide capillary and bulb of copper or stainless (corrosion resistant where required). Equip bulbs in water lines with separate wells of same material as bulb. Support and protect capillary and bulbs by installing in through conduit.
 - 1. Provide scale settings and differential settings where applicable, which are clearly visible and adjustable from front of instrument.
 - 2. Equip on off remote bulb thermostats with precision snap switches, and with electrical rating as required by application.
 - 3. Provide modulating remote bulb thermostats of potentiometer type constructed so that complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

C. Room Thermostats

1. Provide room thermostats with readily accessible adjustment devices and 5-degree dead band capability and 55°F night setback capability.
 - a. Provide thermostats with red-reading glass or spiral bi-metallic thermometers.
 - b. Low Voltage On-Off Thermostats: Comply with general requirements indicated for line-voltage thermostats. Provide thermostats of bimetal operated mercury-switch type, with either adjustable or fixed universal anticipation heater.
2. Electronic Programmable Room Heating/Cooling Thermostats
 - a. Field-installed programmable, manual staged auto-changeover electronic digital thermostat. The thermostat shall offer three heating and two cooling stages with temperature control. An OFF-HEAT Auto-Cool Emerg system switch, OFF-AUTO fan switch and indicating LED's shall be provided along with 7-day programming.
 - b. The thermostat must also be programmable for Occupied / Unoccupied status. During Occupied, the supply fan shall remain on, and the unit to cycle heating cooling as required to maintain space setpoint. During Unoccupied cycle, the supply fan is to cycle on with heating / cooling operation in order to maintain setback temperature.
 - c. Thermostat is also to provide auxiliary contact to engage auxiliary fans (heat recovery) whenever the thermostat is in Occupied mode. During unoccupied mode, the auxiliary fan signal should be off.
 - d. Provide Honeywell T7350H Programmable thermostat or equivalent. Provide with remote located space sensor where indicated on drawings. Coordinate exact location with work of other trades and furnishings and/or equipment. Also provide with web interface control equal to Honeywell "WebStat W7350A1000

2.03 SENSORS

- A. Electronic Sensors General: Provide electronic temperature sensors of supersensitive resistance type, which are vibration and corrosion resistant, and of wall mounted immersion, duct mounting, averaging or bulb type as required for application.
- B. Electronic Sensors: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
 1. Thermistor temperature sensors as follows:
 - a. Accuracy: Plus or minus 0.5 deg F at calibration point.
 - b. Wire: Twisted, shielded-pair cable.
 - c. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
 - d. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - b. Output: 4 to 20 mA.
 3. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.
- C. Equipment operation sensors as follows:
1. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
- D. Electric Contactors
1. Provide contactors for operating or limit-control of electric heating loads, which are UL-listed for 100,000 cycles of resistive loads. Equip with replaceable molded coils and replaceable silver cadmium oxide contacts. Coat core laminations with heat-resistant inorganic film to reduce core losses. Provide line and load terminals on contactors with higher-than-35-amp rating, or provide one-piece formed-and-welded pressure type. Provide screw-type contactors for 35-amp-or-lower rating. Equip field-mounted contactors with suitable steel enclosures; and provide open-type mounting for those installed in factory-fabricated panels.
- E. Local Control Panels
1. Provide control panels with suitable brackets for either wall or floor mounting and proper NEMA rating for location, for each supply fan and miscellaneous control system. Locate panel adjacent to systems served.
 - a. Match NEMA rating and material of panel construction with panels provided by Division 26 work in each space. Coordinate with Division 26 contractor.
 - b. Utilize minimally sized panels for application. Overly large panels with large amount of empty space will be rejected and will require the contractor to replace with acceptable size.

PART 3 EXECUTION

3.01 GENERAL

- A. Examine areas and conditions under which electric control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 SEQUENCE OF OPERATION

- A. Main Rest Area Building
1. Vestibules and Toilet Rooms
 - a. Electric unit heaters EWH-1 through EWH-4 to be controlled by integral thermostats.
 - 1) Units to cycle on/off as required to maintain thermostat setpoints.

- b. Electric radiant ceiling panels RCP-1 and RCP-2 to be controlled by wall mounted thermostats.
 - 1) Units to cycle on/off as required to maintain thermostat setpoints.
 - 2. Storage Room 110 exhaust fan:
 - a. Interlock exhaust fan EF-1 with light switch to turn fan "On" when light switch is "On". Open OA damper when fan is "On".
 - 3. Mechanical Rooms
 - a. Furnaces (GFF-1 through GFF-4) and Condensing units (ACCU-1 through ACCU-4) to be controlled by room thermostat as follows:
 - b. Furnace supply fans shall operate continuously in order to draw in O.A. from energy recovery units with return air and provide a positive pressure to the building.
 - c. Furnaces and Condensing units shall cycle heating or cooling operation as required to maintain space temperature setpoint.
 - d. No setback will be required for the building.
 - e. Space temperature to be set and adjusted within the range of 70 to 75 deg F. Caution should be taken to maintain a lower limit mixed air return temperature no lower than 54 deg F.
 - f. Energy Recovery System.
 - 1) System consists of an energy recovery unit with supply and exhaust fans and outside/exhaust air dampers.
 - 2) Unit shall run continuously during occupied mode.
 - 3) When unit is "On" supply and exhaust fans shall run continuously, outside and exhaust dampers shall be open.
 - g. Economizer Control (Control through Honeywell "JADE" W7220 or approved equal):
 - 1) Enable while GFF-1, GFF-3 or GFF-4 systems is in cooling mode and outside air temperature is <60 deg F. (adj.).
 - 2) Furnace supply fans and energy recovery systems fans (supply and exhaust) shall be "On".
 - 3) Relief fan RF-1 shall be "On" when GFF-1 is in economizer control mode.
 - 4) Relief fan RF-2 shall be "On" when GFF-3 and GFF-4 are both in economizer control mode.
 - 5) Modulate outside air, return air and relief air dampers to maintain 55 deg F supply air temperature.
 - 6) Disable DX condensers during economizer control mode.
 - 4. Detached Storage Building
 - a. Gas-fired unit heater GUH-1 to be controlled by room thermostat. On a call for heat, the unit is to cycle on to heat the space. When the space heating requirements are satisfied, GUH-1 is to cycle off.

3.03 INSTALLATION OF ELECTRIC CONTROL SYSTEMS

A. General

1. Install systems and materials according to manufacturer's instructions and roughing-in drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable Division-26 sections of these specifications. Mount controllers at convenient locations and heights. Provide working HVAC control system utilizing industry standard electric control devices and as specified. Finished Controls shall operate HVAC equipment as Control sequences call for.
2. Provide accessories such as mounting brackets, fasteners, supports, etc. which are compatible with environment where devices will be located. In corrosive environments, use stainless steel materials.
3. Install local control panels for equipment as listed.
4. Where necessary for proper Sequence Operation, install contactors to allow for automatic control.

B. Control Wiring: The term "control wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connecting electric control devices.

C. Wiring System: Install complete control wiring system for electric control systems. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

D. Number-code or color-code conductors, excluding those used for local individual room controls, appropriately for future identification and servicing of control system. Also label all remote control devices with identification consistent with shop drawing and maintenance manuals.

E. Reset Limit Controls: Install manual-reset limit controls to be independent of power controllers; automatic duct heater resets may, at contractor's option, be installed in interlock circuit of power controllers.

F. Unit-Mounted Equipment: Where control devices are indicated to be unit-mounted, ship electric relays, electric switches, valves, dampers, and damper motors to unit manufacturer for mounting and wiring at factory.

1. Provide accessories such as mounting brackets, fasteners, supports, etc. which are compatible with environment where devices will be located. In corrosive environments use stainless steel materials.
2. Dampers/damper motors supplied with equipment such as fans, makeup air units and etc...: Make final connections between damper motors and fan/blower so that dampers open when fans operate and close when fans shut down.

3.04 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26.
- B. Install building wire and cable according to Division 26.
- C. Install signal and communication cable according to Division 26.
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway.
 - 3. Install concealed cable in raceway.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, and electrical connections.
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
 - 3. Calibration test electric controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
- B. Engage a factory-authorized service representative to perform startup service.
- C. Replace damaged or malfunctioning controls and equipment.
 - 1. Start, test, and adjust control systems.
 - 2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
 - 3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.06 ADJUSTING AND CLEANING

- A. Start-UP
 - 1. Start-up, test, and adjust electric control systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- B. Cleaning
 - 1. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- C. Final Adjustment
 - 1. After completion of installation, adjust thermostats, control valves, motors, and similar equipment provided as work of this section, verify control sequence operation. Provide verification documentation.
 - a. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

3.07 CLOSEOUT PROCEDURES

- A. Owner's Instructions
 - 1. Provide services of manufacturer's technical representative for two separate 4-hour days to instruct owner's personnel in operation and maintenance of electric control systems. The first training session shall be an initial overview with enough information for the owner to understand the functionality, adjustment capability, etc. A subsequent follow-up training session is to take place with the owner after the owner has spent time using the controls and has a chance to develop additional questions, etc...
 - 2. Schedule instruction with owner; provide at least 7-day notice to contractor and engineer of initial training date. The follow-up training date shall be coordinated with the owner.

SECTION 23 11 23 - FACILITY NATURAL GAS PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping and tubing joining materials.
 - 3. Valves.

1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.04 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

1.06 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- B. Field quality-control reports.

1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.09 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08.

PART 2 PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

2.02 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.

2.03 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.

4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- C. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
 2. Body: Bronze, complying with ASTM B 584.
 3. Plug: Bronze.
 4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Operator: Square head or lug type with tamperproof feature where indicated.
 6. Pressure Class: 125 psig.
 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.04 PRESSURE REGULATORS

- A. General Requirements:
 - 1. Single stage and suitable for natural gas.
 - 2. Steel jacket and corrosion-resistant components.
 - 3. Elevation compensator.
 - 4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
- B. Appliance Pressure Regulators: Comply with ANSI Z21.18.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
 - 2. Body and Diaphragm Case: Die-cast aluminum.
 - 3. Springs: Zinc-plated steel; interchangeable.
 - 4. Diaphragm Plate: Zinc-plated steel.
 - 5. Seat Disc: Nitrile rubber.
 - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 - 8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 - 9. Maximum Inlet Pressure: 1 psig.

2.05 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International Ltd.
 - e. Matco-Norca, Inc.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.

2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 250 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- O. Concealed Location Installations:
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance.

3.04 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 4.

3.06 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.07 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

3.08 PAINTING

- A. Comply with requirements in Section 09 for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (gloss).
 - d. Color: Gray.
- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.09 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.11 OUTDOOR PIPING SCHEDULE

- A. Aboveground natural-gas pipings shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, distribution piping shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.

SECTION 23 23 00 - REFRIGERANT PIPING AND SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Piping.
 - 2. Refrigerant.
 - 3. Moisture and liquid indicators.
 - 4. Refrigerant Piping Insulation

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI/ASHRAE 34 Number Designation of Refrigerants
 - 2. ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
 - 3. ANSI/ASME B31.5 Refrigeration Piping
 - 4. ANSI/ARI 710 Driers, Liquid-Line
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM B32 Specification for Solder Metal
 - 2. ASTM B280 Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

PART 2 PRODUCTS

2.01 PIPING

- A. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.
 - 1. Fittings: ANSI/ASME B16.22 wrought copper.
 - 2. Joints: ANSI/ASTM B32, solder Grade 95TA or ANSI/AWS A5.8 BCup silver braze.
- B. Factory precharged and preinsulated linesets are acceptable.

2.02 REFRIGERANT

- A. Refrigerant: As indicated on Condensing Unit Schedule.

2.03 MANUFACTURERS

- A. All refrigeration specialties to be of same manufacturer: Sporlan or Alco.

2.04 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single or Double port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; suitable for system working pressure and temperature.

2.05 REFRIGERANT PIPING INSULATION

- A. Flexible, close-cell elastomeric pipe insulation conforming to ASTM C534 Grade 1, Type I: AP Armaflex with appropriate adhesive; Armaflex 520.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Furnish and Install refrigeration piping and specialties according to manufacturer's instructions and according to air cooled condensing unit manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- E. Provide non conducting dielectric connections when joining dissimilar metals.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access fittings.
- H. Provide access to concealed fittings.
- I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- J. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.
- K. Insulate piping per insulation manufacturers recommendations. All insulation exposed to sunlight or installed outdoors shall be protected with two coats of WB Armaflex Finish or weather resistant coating.
- L. Fully charge completed system with refrigerant after testing.
- M. Provide refrigerant charging valve connections in liquid line between receiver shut off valve and expansion valve.

3.03 FIELD QUALITY CONTROL

- A. Test refrigeration system according to ANSI/ASME B31.5.
- B. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using halide torch electronic leak detector. Test to no leakage.

SECTION 23 31 13 - METAL DUCTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:
 - 1. Rectangular ducts and fittings.
 - 2. Single-wall, round spiral-seam ducts and formed fittings.
- B. Related Sections include the following:
 - 1. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.04 QUALITY ASSURANCE

- A. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 PRODUCTS

2.01 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M, Type 316, and having a No. 2D finish for concealed ducts and for exposed ducts.
- D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 DUCT LINER

- A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
 - 1. Manufacturers:
 - a. CertainTeed Corp.; Insulation Group.
 - b. Johns Manville International, Inc.
 - c. Knauf Fiber Glass GmbH.
 - d. Owens Corning.
 - 2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
 - a. Thickness: 1 inch
 - b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
 - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
 - 1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
 - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
 - 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.03 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

- B. Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.
- C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.04 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
 - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
 - 3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
 - 3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.05 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Nexus Inc.
 - c. Ward Industries, Inc.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Lockformer.
 - 2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
 - 3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.06 APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
- B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

- F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
- G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - 1. Fan discharges.
 - 2. Intervals of lined duct preceding unlined duct.
 - 3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.
- I. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - 1. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
- J. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.07 ROUND DUCT AND FITTING FABRICATION

- A. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Duct Joints:
 - 1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 - 2. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
 - a. Manufacturers:
 - 1) Ductmate Industries, Inc.
 - 2) Lindab Inc.
- C. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- D. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

- E. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
 - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
 - a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
 4. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
 5. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 6. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 7. Round Elbows Larger Than 14 Inches in Diameter: Fabricate gored elbows unless space restrictions require mitered elbows.
 8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
 9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
 10. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

PART 3 EXECUTION

3.01 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
1. Supply Ducts: 1-inch wg.
 2. Return Ducts (Negative Pressure): 1-inch wg.
 3. Exhaust Ducts (Negative Pressure): 1-inch wg.
- B. All ducts shall be galvanized steel except as follows:
1. Residential Type Clothes Dryer Exhaust Ducts:
 - a. Type 316, stainless steel..
 - b. Aluminum, with seams and laps arranged on top of duct.

3.02 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire-dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire dampers are specified in Division 23 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7.
- O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

- P. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.03 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
 - 1. For pressure classes lower than 2-inch wg, seal transverse joints.
- B. Seal ducts before external insulation is applied.

3.04 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
 - 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
 - 3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.

4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.07 CLEANING NEW SYSTEMS

- A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
- B. Use service openings, as required, for physical and mechanical entry and for inspection.
 1. Create other openings to comply with duct standards.
 2. Disconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling sections to gain access during the cleaning process.
- C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.
- D. Clean the following metal duct systems by removing surface contaminants and deposits:
 1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Furnace unit internal surfaces and components including coil section, condensate drain pans, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
- E. Mechanical Cleaning Methodology:
 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

- F. Cleanliness Verification:
 - 1. Visually inspect metal ducts for contaminants.
 - 2. Where contaminants are discovered, re-clean and reinspect ducts.

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Volume dampers.
 - 3. Motorized control dampers.
 - 4. Fire dampers.
 - 5. Turning vanes.
 - 6. Duct-mounting access doors.
 - 7. Flexible connectors.
 - 8. Flexible ducts.
 - 9. Duct accessory hardware.
- B. Related Sections include the following:
 - 1. Division 23 Section "HVAC Instrumentation and Controls" for electric and pneumatic damper actuators.

1.03 SUBMITTALS

- A. Product Data: For the following:
 - 1. Backdraft dampers.
 - 2. Volume dampers.
 - 3. Motorized control dampers.
 - 4. Fire dampers.
 - 5. Turning vanes.
 - 6. Duct-mounting access doors.
 - 7. Flexible connectors.
 - 8. Flexible ducts.

- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Special fittings.
 - 2. Manual-volume damper installations.
 - 3. Motorized-control damper installations.
 - 4. Fire-damper installations, including sleeves and duct-mounting access doors.
 - 5. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.05 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

- D. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 BACKDRAFT DAMPERS

- A. Manufacturers:
 - 1. Air Balance, Inc.
 - 2. American Warming and Ventilating.
 - 3. CESCO Products.
 - 4. Duro Dyne Corp.
 - 5. Greenheck.
 - 6. Penn Ventilation Company, Inc.
 - 7. Prefco Products, Inc.
 - 8. Ruskin Company.
 - 9. Vent Products Company, Inc.
- B. Description: Multiple-blade, parallel action gravity balanced, with blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- C. Frame: 0.052-inch- thick, galvanized sheet steel with welded corners.
- D. Blades: 0.025-inch- thick, roll-formed aluminum.
- E. Blade Seals: Vinyl.
- F. Blade Axles: Nonferrous.
- G. Tie Bars and Brackets: Galvanized steel.
- H. Return Spring: Adjustable tension.

2.04 VOLUME DAMPERS

- A. Manufacturers:
 - 1. Air Balance, Inc.
 - 2. American Warming and Ventilating.
 - 3. Flexmaster U.S.A., Inc.
 - 4. McGill AirFlow Corporation.
 - 5. METALAIRE, Inc.

6. Nailor Industries Inc.
 7. Penn Ventilation Company, Inc.
 8. Ruskin Company.
 9. Vent Products Company, Inc.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
 3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
 6. Blade Axles: Galvanized steel.
 7. Bearings: Oil-impregnated bronze.
 8. Tie Bars and Brackets: Aluminum.
 9. Tie Bars and Brackets: Galvanized steel.
- D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
1. Steel Frames: U-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
 3. Aluminum Frames: U-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
 6. Blade Axles: Galvanized steel.
 7. Bearings: Molded synthetic thrust or ball.
 8. Blade Seals: Vinyl.
 9. Jamb Seals: Cambered aluminum.
 10. Tie Bars and Brackets: Galvanized steel.

- E. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.05 MOTORIZED CONTROL DAMPERS

- A. Manufacturers:
 - 1. Greenheck.
 - 2. Nailor Industries Inc.
 - 3.
 - 4. Ruskin Company.
- B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch- thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- thick, galvanized-steel damper blades with maximum blade width of 8 inches.
 - 1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 - 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
 - 3. Provide opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is being held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.06 FIRE DAMPERS

- A. Manufacturers:
 - 1. Greenheck.
 - 2. Nailor Industries Inc.
 - 3. Ruskin Company.
- B. Fire dampers shall be labeled according to UL 555.
- C. Fire Rating: 1-1/2 hours.
- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
 - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Fusible Links: Replaceable, 165 deg F rated.

2.07 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Duro Dyne Corp.
 - c. METALAIRE, Inc.
 - d. Ward Industries, Inc.
- C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.08 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Greenheck.
 - c. Nailor Industries Inc.
 - d. Ventfabrics, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:
 - a. Less than 12 Inches Square: Secure with two sash locks.
 - b. Up to 18 Inches Square: Two hinges and two sash locks.
 - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Flexmaster U.S.A., Inc.
 2. Frame: Galvanized sheet steel, with spin-in notched frame.

2.09 FLEXIBLE CONNECTORS

- A. Manufacturers:
 1. Ductmate Industries, Inc.
 2. Duro Dyne Corp.
 3. Ventfabrics, Inc.
 4. Ward Industries, Inc.
 - 5.
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 1. Minimum Weight: 26 oz./sq. yd..
 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F.
 4. .

2.10 FLEXIBLE DUCTS

- A. Manufacturers:
 1. Flexmaster U.S.A., Inc.
 2. Hart & Cooley, Inc.
 3. McGill AirFlow Corporation.

- B. Insulated-Duct Connectors: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 210 deg F.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

2.11 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 EXECUTION

3.01 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel.
- B. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- D. Provide balancing dampers for all diffuser and equipment connections unless noted otherwise.
- E. Provide additional balancing dampers that are required to achieve a balanced system but not shown on the drawings. Install balancing dampers a minimum of two duct widths from branch takeoff.
- F. Provide test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire dampers, with fusible links, according to manufacturer's UL-approved written instructions.

- H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
 - 1. Downstream from volume dampers, turning vanes, and equipment.
 - 2. Adjacent to fire dampers, providing access to reset or reinstall fusible links. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
 - 3. On sides of ducts where adequate clearance is available.
- I. Install the following sizes for duct-mounting, rectangular access doors:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
- J. Install the following sizes for duct-mounting, round access doors:
 - 1. One-Hand or Inspection Access: 8 inches in diameter.
 - 2. Two-Hand Access: 10 inches in diameter.
- K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment."
- L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- M. Connect diffusers to low pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- N. Connect flexible ducts to metal ducts with draw bands.
- O. Install duct test holes where indicated and required for testing and balancing purposes.

3.02 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Ceiling-mounting ventilators.
 - 2. In-line centrifugal fans.

1.03 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on actual site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.04 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material gages and finishes.
 - 5. Dampers, including housings, linkages, and operators.
- B. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Lift and support units with manufacturer's designated lifting or supporting points.

1.07 COORDINATION

- A. Coordinate size and location of structural support members.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cook, Loren Company.
 - 2. Greenheck Fan Corp.
 - 3. Penn Ventilation Companies, Inc.
 - 4. Twin City Fan and Blower

2.02 CEILING-MOUNTING VENTILATORS

- A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- B. Housing: Steel.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- E. Accessories:
 - 1. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - 2. Isolation: Rubber-in-shear vibration isolators.

2.03 IN-LINE CENTRIFUGAL FANS

- A. Description: In-line, variable speed, direct-drive centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

- C. Direct-Driven Units: Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.
- D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- E. Accessories:
 - 1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 2. Companion Flanges: For inlet and outlet duct connections.
 - 3. Speed control mounted near fan for balancing.

2.04 MOTORS

- A. Comply with requirements in Division 23 Section "Motors."
- B. Enclosure Type: Guarded dripproof.

2.05 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support units using spring isolators having a static deflection of 1 inch. Vibration-control devices are specified in Division 15 Section "Mechanical Vibration Controls."
 - 1. .
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and spring hangers. Vibration-control devices are specified in Division 15 Section "Mechanical Vibration Controls."
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Division 23 Section "Mechanical Identification."

3.02 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

- A. Equipment Startup Checks:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.

SECTION 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
 - 1. Division 08 Section for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Division 23 Section "Air Duct Accessories" for fire dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.03 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

PART 2 PRODUCTS

2.01 GRILLES, REGISTERS AND DIFFUSERS

- A. Grilles, registers and diffusers shall be as manufactured by Titus, Price or Nailor.
- B. Types, sizes, patterns, deflections, finishes, and all accessories are scheduled on the drawings.
- C. All grilles registers and diffusers shall be compatible with adjacent wall and ceiling systems. Confirm ceiling type with architectural plans and provide appropriate frame.
- D. Provide 3 operating keys for each type of volume damper.
- E. Provide galvanized sheet metal transitions, collars, or plenums for attaching grilles to ductwork.
- F. All grilles, registers, and diffusers located in suspended lay-in ceilings shall be with compatible with the following ceiling grid system[s]:
 - 1. Standard width 15/16" ceiling tees.
 - 2. Narrow width 9/16" ceiling tees.

2.02 AIR SLOT DIFFUSERS WITH INSULATED PLENUMS

- A. Air slot diffusers with insulated plenums shall be as manufactured by Titus, Price or Nailor.
- B. Types, sizes, patterns, deflections, finishes, and all accessories are scheduled on the drawings.
- C. Diffuser plenums shall be constructed of 24 gauge galvanized steel and provided with perforated air distribution baffle and air slots with steel mounting channel and tees. Plenum shall be furnished with round or oval duct inlet collar. Match duct collar sizes with inlet duct sizes shown on the drawings.
- D. Slot width shall be nominal 1/2" with quantity and throw pattern indicated. Where shown on drawings slot diffusers shall have pattern controller for adjustment of supply air from horizontal to vertical discharge.
- E. Internal insulation of slot diffuser plenums shall be 1/2" thick FRK faced fiberglass insulation attached to interior of plenums with adhesive and fasteners. Insulation shall conform to U.L. 181 and NFPA 90A requirements.

- F. The diffusers shall be provided with off-white finish.
- G. All slot diffusers shall be compatible with adjacent ceiling systems. Confirm ceiling type with architectural plans.
- H. All slot diffusers located in suspended lay-in ceilings shall be with compatible with the following ceiling grid system(s):
 - 1. Standard width 15/16" ceiling tees.
 - 2. Narrow width 9/16" ceiling tees.

PART 3 PART 3 EXECUTION

3.01 GRILLES, REGISTERS AND DIFFUSERS

- A. Install ceiling grilles, diffusers and registers where shown on drawings.
- B. Coordinate exact location of ceiling grilles, diffusers and registers with new electrical lighting and architectural reflected ceiling plans.
- C. Confirm proper orientation of all units with unit manufacturer.
- D. Paint ductwork visible behind air outlets and inlets matte black.

3.02 AIR SLOT DIFFUSERS

- A. Install slot diffusers where shown on the plans.
- B. Coordinate exact location of diffusers with new electrical lighting and architectural reflected ceiling drawings. Confirm proper orientation of all units with unit manufacturer.
- C. Connections from duct to plenum shall be with flexible air duct.4. Verify that manual and automatic volume control dampers in connected ductwork systems are in fully open position.
 - 5. Disable automatic temperature-control operators.
- B. Starting Procedures:
 - 1. Energize motor and adjust fan to indicated rpm.
 - 2. Measure and record motor voltage and amperage.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Shut unit down and reconnect automatic temperature-control operators.

- F. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- G. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

3.05 CLEANING

- A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
- B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain power ventilators.
 - 1. Train owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals.
 - 3. Schedule training with owner, through architect, with at least seven days' advance notice.

SECTION 23 54 16 - FORCED AIR FURNACES AND EVAPORATOR COILS

PART 1 GENERAL

1.01 SUMMARY

- A. Forced air furnaces.
- B. Refrigerant cooling coil.
- C. Controls.

1.02 RELATED SECTIONS

- A. Section 23 63 13 – Air Cooled Condensing Units

1.03 REFERENCES

- A. Air Conditioning and Refrigeration Institute (ARI):
 - 1. ARI 210/240 -Unitary Air Conditioning and Air-Source Heat Pump Equipment
 - 2. ARI 520 -Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units
 - 3. ARI 630 -Selection, Installation and Servicing of Humidifiers
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - 1. ASHRAE 14 -Methods of Testing for Rating Positive Displacement Condensing Units
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 90A- Installation of Air Conditioning and Ventilating Systems
- D. American National Standards Institute (ANSI):
 - 1. ANSI Z223.1- National Fuel Gas Code
 - 2. ANSI/ASHRAE 90A - Energy Conservation in New Building Design
 - 3. ANSI/ASHRAE 103 - Heating Seasonal Efficiency of Central Furnaces and Boilers, Methods of Testing
 - 4. ANSI/NEMA MG1 - Motors and Generators
 - 5. ANSI/NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
 - 6. ANSI/NFPA 211 - Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

1.04 SUBMITTALS

- A. Submit shop drawings according to the General Conditions and Division 01.

1.05 MINIMUM WARRANTY REQUIREMENTS

- A. Furnace Heat Exchanger: 20 year Heat Exchanger Limited Warranty and 5 year Limited Warranty on entire unit.
- B. Cased Cooling Coil: Standard limited 5-year warranty on parts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide units with capacities as scheduled on drawings.
- B. Acceptable Manufacturers:
 - 1. Carrier.
 - 2. Trane.

2.02 MANUFACTURED UNITS

- A. Configuration: Upflow, type as shown on drawings with gas burner and direct expansion refrigeration. Single or two-stage as scheduled on drawings.
- B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls, air filter, concentric vent kit, refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan
- C. Refrigerant: Puron (R-410A).
- D. Construction and Ratings: According to ARI 210/240. Testing: ASHRAE 14.
- E. Performance Ratings: Energy Efficiency Rating (EER) not less than requirements of ANSI/ASHRAE 90A; seasonal efficiency to ANSI/ASHRAE 103. Provide units with meet or exceed the requirement of those scheduled on the drawings.
- F. Heating Capacity and Staging: As scheduled on plans.
- G. Air Handling: As scheduled on plans.
- H. Cooling Capacity and Staging: As scheduled on plans.

2.03 FABRICATION

- A. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- B. Heat Exchanger:
 - 1. Primary: 3-Pass 20 gauge corrosion resistant aluminized steel of fold and crimp sectional design which operates under negative pressure
 - 2. Secondary: flow-through design having a interior laminate coating of polypropylene for corrosion resistance with fold and crimp design which operates under negative pressure
 - 3. Power vent fan, single or 2 speed as applicable.
- C. Supply Fan: Centrifugal type rubber mounted with direct drive.
- D. Motor: ANSI/NEMA MG 1; 1750 rpm rubber isolated hinge mounted, 4 speed.
- E. Air Filters: Two-inch thick glass fiber, disposable type arranged for easy replacement.

2.04 BURNER

- A. Gas Burner: Sealed combustion type with power vent fan, slow-opening dual rate gas valve, electric switch gas shut-off; flame proving sensor, hot surface igniter, pressure switch assembly; flame rollout switch, drain tubing and condensate trap,

blower and inducer assembly, 40va transformer for thermostat power. Suitable for use with Natural gas.

B. Burner Operating Controls

1. High Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature and re-energizes when temperature drops to lower safe value.
2. Control Supply Fan: Bonnet temperatures and independent of burner controls, manual switch for continuous fan operation.
3. Single or two stage control as Scheduled

C. Evaporator Coil

1. Coil and Coil Casing: Copper tube aluminum fin assembly, galvanized drain pan, drain connection, refrigerant piping connections and factory installed thermostatic expansion valve, fully insulated cabinet.

D. Operating Controls

1. Adjustable Room Thermostat –heating/cooling: Low voltage, to control burner operation, compressor and condenser fan and supply fan to maintain temperature setting. Refer to section 23 09 33 “HVAC Electric Control Systems”.

PART 3 EXECUTION

3.01 GENERAL

- A. Coordinate furnace, cased cooling coil with air cooled condensing unit furnished under spec section 23 63 13 – Air Cooled Condensing Units. All equipment shall be matched to work together.
- B. Verify pressure of natural gas to furnace. Install stepdown regulator if required.

3.02 EXAMINATION

- A. Verify that floors are ready for installation of units and openings are as indicated on shop drawings. Verify that supports for air cooled condensers are completed.
- B. Verify that proper power supply is available for furnace and condenser package.
- C. Verify that proper fuel supply is available for connection.

3.03 INSTALLATION

- A. Install according to manufacturer's instructions.
- B. Install refrigerant lines from indoor equipment to outdoor condensing units. Insulate as required and recommended by manufacturer. Refrigerant lines are to be insulated.
- C. Install interconnecting control wiring between thermostat, furnace and air cooled condensing unit.

- D. Install to NFPA 90A and ANSI/NFPA 90B.
- E. Install gas fired furnaces to ANSI Z223.1 (NFPA 54).
- F. Provide vent connections to ANSI/NFPA 211.

SECTION 23 55 33 - FUEL FIRED UNIT HEATERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Natural Gas fired, separated combustion unit heaters - propeller fan type.

1.02 REFERENCES

- A. American Gas Association (AGA)
- B. American National Standards Institute (ANSI):
 - 1. ANSI Z223.1 (NFPA 54): National Fuel Gas Code
 - 2. ANSI/ASHRAE 103: Heating Seasonal Efficiency of Central Furnaces and Boilers, Method of Testing
 - 3. ANSI/NFPA 211: Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.

1.03 SUBMITTALS

- A. Submit shop drawings according to the General Conditions and Division 01.

PART 2 PRODUCTS

2.01 MAUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Modine
 - 2. Reznor

2.02 GAS FIRED SEPARATED COMBUSTION UNIT HEATERS - PROPELLER FAN TYPE

- A. General: Install gas fired propeller unit heaters as indicated on schedules. Performance shall be as indicated on the equipment schedule in the plans. Unit heaters shall have American Gas Association design certification. Unit Capacity: The unit input capacity shall be as listed on the plans. The output capacity shall be a minimum of 80% of the input based on steady state thermal efficiency as certified by the American Gas Association.

- B. Heat Exchanger: The heater shall be equipped with either a multi-cell, 4-pass serpentine style steel heat exchanger, or 18 gauge aluminized steel tubes and headers.
- C. Burner: The units shall incorporate a single, one-piece burner assembly with a single or multiple orifice. The burner shall have a continuous wound close pressed stainless steel ribbon separating the flame from the burner interior. All units shall have a single venturi tube and single or multiple orifice supplying fuel to a one-piece burner housing. Each heat exchanger cell shall use balanced draft induction to maintain optimum flame control.
- D. Controls:
 - 1. Controls shall include a single stage gas valve; direct spark multi-try ignition with electronic flame supervision with 100% lockout integrally controlled via a printed circuit control board. The control board shall also incorporate diagnostic lights, DIP switches for fan overrun settings, and a relay for fan only operation. All units shall be equipped with a safety limit switch.
 - 2. All controls shall be enclosed in the sealed control compartment to protect them from accidental damage, dust, and atmospheric corrosion.
- E. Combustion Air and Venting:
 - 1. The unit shall have a factory-installed power venter device to draw combustion air from outside of the building. The outside air shall enter the unit through a factory-installed round inlet air terminal on the rear of the heater. The control compartment shall be sealed and the access door shall be gasketed to prevent dirt, lint, dust, or other contaminants present in the heated space from entering the unit. The control compartment door shall be equipped with a safety interlock switch to prevent operation when the door is open.
 - 2. The combustion air supply pipe and flue exhaust pipe shall be run in parallel from the heater to a factory supplied concentric adapter assembly, which allows for a single wall or roof penetration, to the horizontal air inlet and vent terminal.
 - 3. The combustion air/venting system shall include a vibration isolated power venter motor and wheel assembly and a combustion air pressure switch. Unit shall include a flame rollout switch
- F. Electrical:
 - 1. Operation shall be controlled by an integrated circuit board that includes LED diagnostic indicator lights. Supply voltage connections shall be made in a sealed junction box. 24-volt control connections shall be made on an externally mounted terminal strip with connections (W1, W2, R, and G). All form RZ-NA C-UDAP/S, internal wiring, both line and control voltages, shall be terminated by insulated terminal connectors to minimize shock hazard during service.
 - 2. Each unit shall be equipped for use with 115/1 voltages as scheduled as plans.
 - 3. All units will be equipped with a built-in disconnect switch.

G. Cabinet

1. The cabinet shall be low profile with a pre-coat or powdercoat finish. Finish shall be a minimum 80 gloss on G30 galvanized steel. The cabinet shall be constructed so that screws are not visible from the bottom, front, or sides, except for service panel and accessories. Unit construction shall incorporate a beveled front corner on control side for additional cabinet rigidity. All units shall be manufactured with a tooled drawn supply air orifice on the rear panel to reduce fan inlet noise.
2. The unit shall be designed for ceiling suspension featuring 3/8 inch female threads (hanger kits for 1 inch pipe) at both 2-point and 4-point locations with no additional adapter kits.
3. The cabinet shall be equipped with painted, roll-formed horizontal louvers. Louvers shall be spring held and adjustable for directing airflow.
4. The cabinet shall be equipped with a full safety fan guard with no more than ½ inch grill spacing on sizes 30-125. The enclosed motor and fan assembly shall be resiliently mounted to the cabinet to reduce vibration and noise.
5. The unit shall be designed with a full opening service access panel complete with screw closure attachment and lifting handle for removal. Service panel shall be fully gasketed and equipped with a safety interlock switch. All components in the gas train, all standard electrical controls, and the power venter shall be within the sealed service compartment.
6. Minimum top clearance from combustibles shall be 1 inch for sizes 30-125. Minimum bottom clearance from combustibles shall be 1 inch for all sizes. Minimum clearance from combustibles on non-service side shall be 1 inch for sizes 30-125.

H. Low voltage room thermostat to be provided under Specification Section 23 09 33.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available.
- C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

- A. Install according to manufacturer's instructions.
- B. Installed condensate drip leg with drain port on all vents. Drip leg to be sealed watertight. Install CPVC trap and drain line to drain port. Route to nearest drain or out through wall to grade. Coordinate with engineer.

- C. Startup units according to manufacturer's instructions. Measure, adjust and set manifold gas pressure to factory recommendations utilizing a manometer to properly read pressures. Adjust anticipator on room thermostats serving unit heaters to factory recommendations for type and model. If condensate dripping occurs from vent pipe, install additional insulation on vent/combustion air combination box.
- D. Install to NFPA 90A.
- E. Install gas-fired units to ANSI Z223.1 (NFPA 54).
- F. Provide vent connections to ANSI/NFPA 211.
- G. Install unit heaters with vibration isolation.

SECTION 23 63 13 - AIR COOLED CONDENSING UNITS

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes design, performance, refrigerants, controls, and installation requirements for air cooled compressor-condensing units associated with the Fuel Fired Furnace.

1.02 REFERENCES

- A. Comply with the applicable Standards and/or Codes of ETL, cETL, NEC, ASHRAE Standard 90.1, and OSHA as adopted by the State.

1.03 SUBMITTALS

- A. Submit shop drawings and product data according to the specifications.
- B. Submittals shall include the following:
 - 1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections.
 - 2. Summary of all auxiliary utility requirements such as: electricity, water, gas, etc.
 - 3. Summary shall indicate quality and quantity of each required utility.
 - 4. Single line schematic drawing of the power field hookup requirements, indicating all items, which are furnished.
 - 5. Diagram showing Refrigerant piping between condensing unit and DX coils in air handling unit. Show all required line sizes, traps, risers, double risers if needed.

6. Schematic diagram of control system indicating points for field interface and/or connection.
7. Diagram shall fully delineate field and factory wiring.
8. Installation manuals.

1.04 QUALITY ASSURANCE

- A. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have ten years experience with the equipment and refrigerant offered.
- B. Regulatory Requirements: Comply with the codes and standards specified.

1.05 DELIVERY AND HANDLING

- A. Condensing unit shall be delivered to the jobsite with a factory holding charge and be factory charged with oil by the manufacturer.
- B. Comply with the manufacturers instructions for rigging and handling equipment.

1.06 WARRANTY

- A. The refrigeration equipment manufacturer's warranty shall be for a period of one year from date of equipment start up but not more than 14 months from shipment. The warranty shall cover material and workmanship that prove defective within the above period, excluding refrigerant.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Provide condensing units of same manufacturer as the air handling/furnace equipment for which it is connected:
 1. Carrier
 2. Trane

2.02 UNIT DESCRIPTION

- A. Provide and install as shown on the plans factory assembled, air cooled compressor condensing units in the quantity specified. Each unit shall consist of a hermetic compressor(s), air cooled condenser section, control system, suction and liquid connection valves, and all components necessary for safe and controlled unit operation when connected to the specified low side equipment.

2.03 DESIGN REQUIREMENTS

- A. General: Provide a complete compressor-condensing unit as specified herein and as shown on the drawings. The unit shall be according to the standards referenced in section 1.02 and any local codes in effect.

- B. Performance: Refer to the schedule of performance on the drawings. The unit shall be capable of stable operation to a minimum of 35°F outdoor temperature. Provide Low Ambient accessory option.
- C. Refrigerant: Puron (410-A)

2.04 CONDENSING UNIT FEATURES

- A. Compressors: The compressors shall be scroll type with a forced feed lubrication system and oil charge. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two pole, with inherent thermal protection on all phases and shall be mounted on RIS vibration isolators. All Models shall be furnished with a crankcase heater.
- B. Condenser: The condenser coil(s) shall consist of seamless copper tubes mechanically bonded into plate type fins. The fins shall have full drawn collars to completely cover the tubes. A subcooling section shall be an integral part of the main condenser coil. Condenser fan(s) shall be propeller type arranged for vertical air discharge and individually driven by direct drive fan motor(s). The fan discharge area shall be equipped with a heavy gauge fan guard. Fan motor(s) shall be weather protected, single phase, direct drive, 1100 rpm, open drip proof type. The condenser coil(s) shall be mechanically protected from physical damage by a wire guard covering the full face area of the coil.
- C. Refrigerant Circuit: The condensing unit shall be furnished with a liquid line filter drier and service valves for liquid and suction connections. The finished field installed refrigerant circuit furnished by the contractor shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line (insulated hot gas bypass line) and insulated suction line.
- D. Control System: A centrally located weatherproof control panel shall contain the field power connection points, control terminal block and control system. Power and starting components shall include fan motor contactors, time delay relay(s) for the compressor(s), inherent fan motor overload protection and unit power terminal blocks for connection to remote disconnect switch. Safety and operating controls shall include a manually reset high pressure switch and an automatic reset low pressure switch. Barrier panels shall be furnished to protect against accidental contact with line voltage when accessing the control system.
- E. Service Accessibility: Entrance to the separate compressor(s) and control compartment shall be through an access panel.

- F. Wiring Diagrams:
1. Wiring diagrams shall be in color and marked to match the color and markings of the wires and shall be both "point to point" and "ladder" diagrams.
 2. Diagrams shall be laminated in plastic and permanently fixed to the control compartment door.
 3. Installation and maintenance manuals shall be supplied with each unit within the control compartment.

2.05 OPTIONS AND ACCESSORIES

- A. Unit shall be supplied with the following options:
1. Cycling condenser fan control for low ambient operation to 35° F (for ACCU-2).
 2. Refrigerant reservoir.
 3. Low ambient kit
 4. Crankcase heater
 5. Liquid line solenoid valve

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents.
- B. Set unit on concrete equipment (housekeeping) pad if located on grade. Adjust and level unit on supports.
- C. Install refrigerant piping according to drawings. Seal exterior wall penetrations weather tight.
- D. Evacuate the system and charge with refrigerant according to standard practice.
- E. Coordinate electrical installation with electrical contractor.
- F. Coordinate controls with control contractor.
- G. Provide all appurtenances required to ensure a fully operational and functional system.

3.02 STARTUP

- A. Check and assure proper system charge of refrigerant and oil.
- B. Provide testing, and starting of system, and instruct the owner in its proper operation and maintenance.

SECTION 23 72 00 - AIR-TO-AIR ENERGY RECOVERY UNITS

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Packaged Fixed-plate heat exchangers with integral fans – Double wall construction of Case enclosure.

1.02 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories.

1.03 QUALITY ASSURANCE

- A. The energy recovery cores used in product shall be certified by ARI under its standard 1060 for Energy Recovery Ventilators. ARI published certifications shall confirm manufacture's published performance for airflow static pressure, temperature and total effectiveness, purge air (OACF) and exhaust air leakage (EATR).
- B. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
- C. Unit shall be listed under UL 1812 Standard for ducted Air to Air Heat Exchangers.
- D. The core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. Balance of Unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics under circumstances of normal use, for a period of two years from the date of purchase.

PART 2 PRODUCTS

2.01 HEAT RECOVERY UNITS WITH PACKAGED FANS

- A. Energy Transfer: Shall be capable of transferring both sensible and latent energy air streams. Latent energy transfer shall be accomplished by direct water vapor transfer from one air stream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.
- B. Passive Frost Control: Energy-transfer element shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above – 10 deg. F and inside relative humidity below 40%). Occasional extreme conditions shall not affect the usual function or performance of the element. No condensate drains will be allowed.

- C. Continuous Ventilation: Unit shall have the capacity to operate continuously without the need for bypass, recirculation, preheaters, or defrost cycles under normal operating conditions.
- D. Positive Air Stream Separation: Water vapor transfer shall be through molecular transport by hygroscopic resin and shall not be accomplished by porous plate mechanisms. Exhaust and fresh airstreams shall at all times travel in separate passages, and airstreams shall not mix.
- E. Laminar Flow: Airflow through the energy exchange element shall be laminar, avoiding deposition of particulates on the interior of the energy plate material.

2.02 CONSTRUCTION

- A. Fixed-plate energy exchange element. Energy exchange module shall be of fixed plate cross flow construction with no moving parts.
- B. No condensate drain pans or drains shall be allowed and unit shall be capable of operating in winter and summer conditions without generating condensate.
- C. The unit case shall be construction of galvanized, 20 gauge steel, with lapped corners and double wall construction.
- D. Unit shall have single point power connection. Provide unit with NEMA rated disconnect switch and Magnetic starter relays within proper NEMA enclosure. Unit to start and stop automatically based on interlock control with other HVAC equipment.
- E. Fans shall provide capacity as scheduled on drawings.
- F. Blower motors shall be Premium Efficiency, EISA compliant for energy efficiency. The blower motors shall be totally enclosed and be supplied with factory installed motor starters. Direct drive models shall be EISA-compliant for energy efficiency with open drip proof design and integral thermal protection.
- G. Flange components shall be provided suitable for connection of ductwork.
- H. Access doors shall provide easy access to energy transfer elements, and filters. Panel shall be gasketed to provide air-tight seal.
- I. Case walls and doors shall be insulated with 1" FSK high density board insulation, eliminating the possibility of exposing the fresh air to glass fibers. Insulation shall be sandwiched within double wall construction.
- J. Energy exchange element shall be protected by a MERV 8 rated 2" nominal pleated disposable filters.

- K. Configuration
 - 1. Unit shall be available from factory with vertical or horizontal return air and/or vertical or horizontal supply air duct connection openings.
- L. Options
 - 1. Refer to equipment schedule.
- M. Manufacturers:
 - 1. RenewAire Energy Recovery Ventilators.
 - 2. Greenheck.
 - 3. Or Pre Approved Equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install units following manufacturer's installation instructions and requirements.
- B. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.
 - 1. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to heat exchanger. Access doors and panels are specified in Division 23 Section "Duct Accessories."
- C. Install floor-mounted units on 4-inch high concrete base.

3.02 CONNECTIONS

- A. Duct and fan installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and specialties.
- B. Ground equipment according to Division 26 Section.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Adjust seals and purge.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 4. Set initial temperature and humidity set points.
 - 5. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

- B. Remove malfunctioning units, replace with new units, and retest as specified above.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain units.

SECTION 23 82 39 - ELECTRIC HEATING UNITS

PART 1 GENERAL

1.01 SUMMARY

- A. Electric Wall Heaters.
- B. Electric Radiant Ceiling Panels.

1.02 REGULATORY REQUIREMENTS

- A. Conform to applicable code for internal wiring of factory wired equipment.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.04 SEQUENCING AND SCHEDULING

- A. Install units (equipment exposed to finished areas) after walls and ceiling are finished and painted. Avoid damage.

PART 2 PRODUCTS

2.01 ELECTRIC WALL HEATERS

- A. Heavy-duty 16 gauge steel bar grille construction with tamper resistant construction and surface mounting box.
- B. Steel finned metal sheath electric heating elements.
- C. Integral thermostat - tamper resistant.
- D. Thermal overload protectors, built in power disconnect switch, built in fan delay switch.
- E. Permanently lubricated totally enclosed fan motor. U.L. listed.
- F. Provide electric wall heaters with capacities as scheduled or indicated on drawings. Acceptable manufacturers to be: QMark type AWH 4000, Markel or TPI.

2.02 ELECTRIC RADIANT CEILING PANELS

- A. Heating equipment shall include a ceiling mounted electric heater designed for ceiling surface or recessed mounting. Heaters shall be UL listed.
- B. Heater assembly shall consist of powered graphite encapsulated in a plastic laminate with heavy duty copper buss bars running the entire length, backed by a 1 inch, 1 pound density high temperature fiberglass insulation to insulate against heat loss to the ceiling and separated from the inside of the panel by a dielectric insulation to assure uniform heat transfer throughout the entire radiating surface of the heater. Thermal cutout: A thermal cutout shall be built into the system to shut off the heater in the event of overheating.
- C. Disconnect switch: A double-pole single throw disconnect switch shall be factory installed for positive disconnect of power supply. It shall be completely concealed behind the faceplate.
- D. Acceptable manufacturer: Qmark model CP, Markel or TPI.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work and opening dimensions are as instructed by the manufacturer.
- B. Verify that required utilities are available, in proper location, and ready for use.
- C. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

- A. Install according to manufacturer's instructions.
- B. Install heaters as indicated.
- C. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Verify that electrical wiring installation is according to manufacturer's submittals and installation requirements of Division 26 sections.

3.03 CLEANING

- A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

74. Rest Area 31 Building Electrical, Item SPV.0105.05.

A Description

This work includes the electrical construction required to complete the rest area buildings according to the applicable plans, the 'General Requirements for Building Construction,' and the technical specifications.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Rest Area No. 31 Building Electrical as a single lump sum unit, complete in place and accepted.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.05	Rest Area 31 Building Electrical	LS

Payment is full compensation for furnishing all materials and equipment and for supplying all labor, tools, equipment, and incidentals necessary to complete the work.

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SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. The Electrical drawings do not attempt to show complete details of building construction which affects the electrical installation. The contractor shall refer to the complete set of project drawings and specifications for additional details, which affect the proper installation of this work.
- B. The mention of any article, operation, or method requires that the contractor shall provide same and perform each operation, in complete accordance with the conditions stated. The contractor shall provide all material, labor, equipment and transportation as necessary to complete the project in compliance with the Contract Documents. In general, this work includes everything essential for a complete electrical system in operating order as shown on the drawings and as specified.
- C. All work shall be installed according to all State and Local Inspection Authorities having jurisdiction together with the recommendations of the manufacturer whose equipment is to be supplied and installed under this Contract. The omission of expressed reference to any item of labor or material necessary for the proper execution of the work according to the present practices of the trade shall not relieve the contractor from providing such additional labor and materials.
- D. Before submitting his bid, each bidder shall examine the drawings relating to his work and shall become fully informed as to the extent and character of the work required and its relation to other work in the building.
- E. The contractor, in conjunction with the architect, shall establish exact locations of all materials and equipment to be installed. Consideration shall be given to construction features, equipment of other trades and requirements of the equipment proper.
- F. All materials shall be suitably stored and protected prior to installation and all work shall be protected after installation, during construction and prior to acceptance.
- G. The contractor shall furnish all scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of all equipment and apparatus required to be installed by the contractor. All such equipment shall be removed by the contractor upon completion of the project.

1.03 PERMITS AND LICENSES

- A. The contractor shall prepare and submit all applications and working drawings, as required, to authorities having jurisdiction over the project. All licenses and permits required shall be secured and paid for by the contractor. The contractor shall submit a copy of all permits secured to the owner.
- B. Provide the owner with a written certificate that all parts of the electrical system have been inspected and final approval has been obtained from the appropriate authority having jurisdiction.
- C. Provide a copy of the electrical permit to the owner representative prior to proceeding with any work.

1.04 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.
- F. Provide: Furnish, install and wire complete and ready for service.
- G. Exposed: Exposed to view in any room, corridor or stairway.
- H. This Contractor: The electrical contractor, also referred to as "the contractor".
- I. Code: National, State and Local Electrical codes including OSHA requirements.
- J. The owner: The individual who the owner selects as his project representative.
- K. Equivalent: Manufacturers or methods listed by name in the specifications, on the drawings or in an addendum are considered to be equivalent subject to Engineer review.
- L. Substitution: Any manufacturer or method other than those listed by name in these specifications, on the drawings, or in an addendum.

1.05 SUBMITTALS

- A. Submit to Engineer for review, the manufacturer's shop drawings and/or equipment brochures in quantities determined by the architect for the following
 1. Panelboards.
 2. Enclosed Switches and Circuit Breakers.
 3. Enclosed Controllers.
 4. Lighting Fixtures.
 5. Grounding materials.
 6. Lighting Control Devices.
 7. Overcurrent Protective Device Coordination Study and Fault Current Study.
 8. Structured Cabling.
 9. Communications Equipment.
 10. Public Address System.
 11. Video Surveillance
- B. Shop drawings shall be submitted in advance of construction and installation so as to not cause delay in other contractor's work and to allow for Engineer's review.
- C. All data submitted for Engineer's review shall be numbered consecutively, shall be noted to correlate with the electrical drawings, and shall bear:
 1. The name and location of the project.
 2. The name of the contractor.
 3. The date of submittal.
 4. The date of the drawings and the date of each correction and revision
 5. If more than one type of lighting fixture (or other material) is on a submitted sheet, the proposed equipment shall be conspicuously checked with red pen by the electrical contractor.
 6. Failure to do this, may result in the submittal(s) being returned to the contractor for correction and re-submission.
 7. Failing to follow these instructions does not relieve the contractor from the requirement of meeting the project schedule.
- D. The contractor shall examine, stamp and sign shop drawings and equipment brochures prior to submission. The contractor shall verify that the materials and equipment depicted will properly fit into the construction. The contractor shall also review all previously completed work related to the installation of the equipment depicted to ensure that it has been properly installed.
- E. No materials or equipment subject to prior review by the Engineer shall be fabricated or installed by the contractor. The Engineer's review of shop drawings shall not relieve the contractor of responsibility for deviations from the requirements of the drawings and specifications, unless prior approval for such deviations has been granted.
- F. Submit additional materials at the request of the Engineer.

- G. Shop drawings shall bear the contractor's stamp indicating approval or approved as noted.
- H. Any equipment fabrication prior to shop drawing review shall be at the contractor's risk.

1.06 MAINTENANCE MANUALS

- A. The contractor shall assemble and submit to the architect for subsequent submission to the owner, three complete sets of a Manual of Operation and Maintenance for each of the electrical and communications systems.
- B. Each manual shall consist of a loose leaf bound volume instructing the owner's personnel in the use, operation and maintenance of the system in question. The manual shall cover all phases of operation and maintenance of the equipment. Manuals shall accurately describe the operation, construction and adjustable features of the complete system and its component parts.
- C. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
 - 1. Copies of all reviewed submittals bearing contractor's stamp indicating approval or approved as noted.
 - 2. Manufacturer's wiring diagrams for electrically powered equipment.
 - 3. Records of tests performed to certify compliance with system requirements.
 - 4. Certificates of inspection by regulatory agencies.
 - 5. Parts lists for manufactured equipment.
 - 6. Preventive maintenance recommendations.
 - 7. Warranties.
 - 8. Overcurrent Protective Device Coordination Study and Fault Current Study Reports.
 - 9. Additional information as indicated in the technical specification sections.

1.07 QUALITY ASSURANCE

- A. Substitution of Materials: Refer to Division 01, General Conditions of the Contract.
- B. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.
- C. Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply
- D. All work and material shall conform with the National Electrical Code (ANSI/NFPA 70).

- E. All materials shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by the architect/engineer, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, shall be so labeled.

1.08 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. The contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.
- D. Coordinate all work with other contractors/subcontractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
- E. Coordinate electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground utilities and services, including provision for electricity-metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- F. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.
- G. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- H. Coordination Meetings: Attend coordination meetings with the architect and all other trades for the purpose of coordinating the locations of all plumbing, HVAC and electrical work for the entire project. The goal of these meetings is to avoid conflicts between trades in the field.

- I. Coordination Drawings: Each fire protection, plumbing, HVAC and electrical contractor shall develop 1/4" coordination floor plan drawings for all of their respective working areas that necessitate additional coordination to allow for efficient systems installation. Each coordination drawing, for all trades, shall be signed and dated by each trade indicating that each trade has fully coordinated their work
- J. Conflicts Between Trades: Resolve all conflicts with trades at no additional cost to the owner or architect/engineer.
- K. Ceiling Heights: Maintain all ceiling heights indicated on the architectural drawings. Ceiling heights will not be lowered to accommodate installation of fire protection, HVAC or electrical work. Install all work so that there is at least eight (8) inches clearance above the ceiling grid, in all areas, to facilitate installation of light fixtures. If installed work does not comply with the ceiling height requirements stated above, then the contractor shall remove and re-install work to comply with the stated requirements above at no additional cost to the owner or architect.
- L. Ceiling Grid Priority: Lighting fixture locations take priority over diffuser and sprinkler head locations.

1.09 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. These specifications and attendant drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material necessary for the proper execution of the work according to present practices of the trade shall not relieve the contractor from providing such additional labor and materials. No later than ten (10) days before bid opening, the contractor shall call the attention of the architect/engineer in writing to any materials or apparatus the contractor believes to be inadequate and to any necessary items of work omitted. If in the opinion of the contractor there are omissions or errors in the plans or specifications, the contractor shall clarify these points in writing with the architect/engineer before submitting his bid. In lieu of written clarification by addendum, resolve all conflicts in favor of the greater quantity or better quality.
- B. The contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.
- C. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits the architect/engineer's intent (as determined by the Engineer). Refer to the General Conditions of the Contract for further clarification.

- D. It must be understood that the details and drawings are diagrammatic. The contractor shall verify all dimensions at the site with the owner's representative and be responsible for their accuracy. Where appropriate the location shall be established according to the manufacturer's installation drawings and details subject to the architect's review.
- E. All sizes as given are minimum except as noted.
- F. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the Authority Having Jurisdiction inspections and A/E's reviews, tests and approval from the commencement until the acceptance of the completed work.
- G. Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply. Refer to Division 01, General Conditions of the Contract.
- H. The contractor shall refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.
- I. Unless specifically stated to the contrary, no measurement of an electric drawing derived by scaling shall be used as a dimension to work by. Dimensions noted on the electric drawings are subject to measurements of adjacent and previously completed work. All measurements shall be performed prior to the actual installation of equipment.

1.10 DRAWINGS

- A. The Electrical drawings do not attempt to show the complete details of building construction which affect the electrical installation. The contractor shall refer to the architectural, civil, structural and mechanical drawings for additional details which affect the proper installation of this work. Bring any discrepancies to the attention of the A/E for resolution. The contractor is cautioned that diagrams showing electrical connections and/or circuiting are diagrammatic only and must not be used for obtaining linear runs of wire to conduit. Wiring diagrams do not necessarily show the exact physical arrangement of the equipment.
- B. The contractor shall be responsible for all existing field conditions, review existing field conditions prior to bid and shall take into account in bid proposal. No additional compensation will be allowed due to contractor's failure to include all necessary work in the bid proposal.

1.11 MATERIAL AND EQUIPMENT

- A. All material and equipment shall be new and of the quality used for the purpose in good commercial practice, and shall be standard product of reputable manufacturers. Each major component of equipment shall have the manufacturer's name, catalog number, and capacity or rating on a nameplate, securely affixed on the equipment in a conspicuous place.

1.12 DAMAGE TO OTHER WORK

- A. The electrical contractor will be held rigidly responsible for all damages to the work of his own or any other trade resulting from the execution of his work. It shall be the contractor's responsibility to adequately protect his work at all times. All damages resulting from his operations shall be repaired or the damaged portions replaced by the party originally performing the work, (to the entire satisfaction of the architect), and all cost thereof shall be borne by the contractor responsible for the damage.

1.13 COOPERATION WITH OTHER TRADES

- A. This contractor shall completely cooperate with all other trades in the matter of planning and executing of the work. Every reasonable effort shall be made to prevent conflict and interferences as to space requirements, dimensions, locations, openings, sleeving or other matters which tend to delay or obstruct the work of any trade.

1.14 NEGLIGENCE

- A. Should the contractor fail to provide materials, templates, etc., or other necessary information causing delay or expense to another party, he shall pay the actual amount of the damages to the party who sustained the loss.

1.15 FIELD CHANGES

- A. Should any change in drawings or specifications be required to comply with local regulations and/or field conditions, the contractor shall refer same to architect/engineer for approval before any work which deviates from the original requirements of the drawings and specifications is started. In the event of disagreements as to the necessity of such changes, the decision of the architect/engineer shall be final.

1.16 CUTTING AND PATCHING

- A. Provide all necessary cutting and patching, and with approval, to permit the installation of conduit or any part of the work under this branch. The contractor shall be responsible for any cost caused by defective or ill-timed work. Patching of holes, openings, etc. resulting from the work of this branch shall be provided by this contractor.

1.17 STANDARDS, CODES AND PERMITS

- A. All work and materials are to conform in every detail to applicable rules and requirements of National, State and Local electrical codes, laws, ordinances, and regulations. Comply with all applicable OSHA regulations.
- B. Conform with other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).

- C. All Division 26 work shall be done under the direction of a currently State Certified Master Electrician.
- D. All materials shall have a U.L. label where a U.L. standard and/or test exists.
- E. Prepare and submit to all authorities having jurisdiction, for their approval, all applications and working drawings required by them. Secure and pay for all permits and licenses required.
- F. Abbreviations of standards organizations referenced in this and other sections are as follows:
 - 1. ANSI American National Standards Institute
 - 2. ASTM American Society for Testing and Materials
 - 3. EPA Environmental Protection Agency
 - 4. ETL Electrical Testing Laboratories, Inc.
 - 5. IEEE Institute of Electrical and Electronics Engineers
 - 6. IES Illuminating Engineering Society
 - 7. ISA Instrument Society of America
 - 8. NBS National Bureau of Standards
 - 9. NEC National Electric Code
 - 10. NEMA National Electrical Manufacturers Association
 - 11. NESC National Electrical Safety Code
 - 12. NFPA National Fire Protection Association
 - 13. UL Underwriters Laboratories Inc.

1.18 CLEAN-UP

- A. Refer to Division 01, General Requirements, Cleaning for additional requirements.
- B. This contractor shall at all times keep the premises free from excessive accumulation of waste material or rubbish resulting from his work, including tools, scaffolding and surplus materials, and he shall leave his work broom-clean or its equivalent. In case of disputes, the architect may order the removal of such rubbish and charge the cost to the responsible contractor as determined by the architect/engineer. At the time of final clean-up all fixtures and equipment shall be thoroughly cleaned and left in proper condition for their intended use.
- C. The contractor shall repair all damage to new and existing equipment resulting from his work. When job is complete, this contractor shall remove all tools, excess material and equipment, etc., from the site.

1.19 TESTS

- A. General: The contractor shall provide all instrumentation, labor and conduct all tests required by the architect. All tests shall be made before any circuit or item of equipment is permanently energized. Circuits shall be phased out and loads shall be distributed as evenly as possible on all phases. All phase conductors shall be entirely free from grounds and short circuits. All instrumentation and personnel required for

testing shall be provided by the contractor and all tests shall be conducted in the presence of the architect or his authorized representative.

B. System Tests:

1. Service and building ground tests.
2. Secondary feeders shall have an insulation resistance test utilizing a megger applying a test potential of 500 volts DC minimum.
3. Establish secondary phase to ground voltages.
4. Set transformer taps to deliver nominal rated voltage.
5. Establish proper phase relationship and motor rotation.

The following tests are required under normal load condition:

6. Record secondary phase to phase and phase to ground voltages and phase currents at all major equipment, apparatus, and on all secondary feeders. Voltage readings shall be taken at line side terminals of distribution centers and panelboards.
7. Confirm proper phase relationship and motor rotation.
8. Confirm load balance at distribution centers and panels. Rebalance load if necessary such that the minimum unbalance between phases shall not exceed 7-1/2%.
9. Reset transformer taps if necessary to deliver nominal rated voltage. Identify final tap settings on transformers nameplates.
10. Confirm operation of all electrically operated apparatus, such as circuit breakers, transfer switches, etc., by exercising same under load.
11. Record all settings and calibrations of circuit breakers, transfer switches, transformers, meters, timing devices, etc.

- C. Records: All test data obtained by the contractor or manufacturer/supplier shall be recorded and filed with the maintenance manual as part of permanent job records. Test data shall include identification of instruments employed, (field test only) condition of test (time, date, weather, etc.), parameters of test, personnel conducting test, and any pertinent information or conditions noted during the test.

1.20 DRAWINGS OF OTHER TRADES

- A. The contractor shall consult the drawings of the work for the various other trades; field layouts of the parties performing the work of the other trades; their shop drawings, and he shall be governed accordingly in laying out his work.
- B. Specifically examine shop drawings of other trades to confirm voltage, current characteristics, and other wiring requirements for utilization equipment. Bring any discrepancies to the attention of the A/E.

1.21 FIELD MEASUREMENTS

- A. The contractor shall take all field measurements necessary for his work and shall assume the full responsibility for their accuracy.

- B. Should any structural interferences prevent the installation of the outlets, running of conduits, etc., at points shown on drawings, the necessary minor deviations therefrom, as determined by the architect, may be permitted. Minor changes in the position of the outlets or equipment if decided upon before any work has been done by the contractor shall be made without additional charge.

1.22 EXAMINATION OF PLANS, SPECIFICATIONS AND SITE

- A. Before submitting a bid, the contractor shall familiarize himself with all features of the building and site which may affect the execution of his work. No extra payment will be allowed for the failure to obtain this information. As soon as possible but no later than ten (10) days before bid opening, the contractor shall call the attention of the architect/engineer in writing of any materials or apparatus the contractor believes to be inadequate and/or any necessary items of work omitted. If the contractor believes there are inadequacies in the specifications or drawings, where clarifications are necessary to complete the project according to the contract documents, the contractor shall clarify these points with the architect/engineer before submitting his bid. In lieu of written clarification by addendum, resolve all conflicts in favor of the greater quantity or better quality.

1.23 GUARANTEE

- A. The contractor shall unconditionally guarantee his work and all components thereof, excluding lamps, for a period of one year from the date of his final payment. He shall remedy any defects in workmanship and repair or replace any faulty equipment which shall appear within the guarantee period to the entire satisfaction of the owner/architect at no additional charge.

1.24 TEMPORARY ELECTRIC

- A. Temporary electrical services include all electric service required up to the time of substantial completion.
- B. As soon as contract is awarded, electrical contractor will make all arrangements for temporary service. A 120/240 volt, 200 ampere, single phase, 3 wire service shall be extended into the building as work progresses and panels provided as necessary to provide a minimum of two weatherproof sockets per 1000 sq. ft. of floor space. Sockets shall be utilized for interior lighting and small fractional HP motors only. Cost of temporary service shall be by the electrical contractor. In addition, install and maintain lamps as required to provide illumination of 1/4 watt per sq. ft. throughout, or as required by any codes or ordinances. Maintain and replace all defective sockets, fuses and wiring. Remove temporary installation upon completion of permanent service. All temporary wiring shall conform all applicable codes including NEC and OSHA.
- C. Install permanent service as soon as practical.

- D. All contractors shall provide and maintain their own extension cords and additional lamps as required to perform their work properly.
- E. Contractors requiring temporary connections to 3 phase power service and single phase feeders for other than lighting and small fractional horsepower motorized tools shall make arrangement with the electrical contractor. Contractors requiring lighting outside of the building shall make their own arrangements with the electrical contractor and pay all costs for installation, maintenance and removal. Contractors requiring electrical equipment over one HP, including welders, hoists, heaters and coolers shall make their own arrangements for such service beyond the main switch and shall pay all costs thereof.
- F. No permanent electrical equipment or wiring shall be used for temporary connections, unless authorized by this Section, upon signed order and with approval by the architect on behalf of the owner. Such approvals shall not shorten guarantee period.

1.25 SUBSTITUTION AND APPROVAL OF MATERIAL, EQUIPMENT OR DESIGN

- A. Such requests shall be accompanied by three copies of all necessary illustrations, cuts, drawings and descriptions of material proposed for substitution and shall fully describe all points in which it differs from the articles specified. The Engineer will retain two copies and one copy returned to the contractor with acceptance, rejection or revisions indicated thereon.
- B. The proposed substitution does not affect dimensions shown on Drawings or as specified.
- C. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
- D. All proposed substitutions will be subject to satisfactory performance to the specification and considered as a deduct alternate rather than as an equivalent.
- E. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs, including architectural/engineering design and construction costs, involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.
- F. All substitution review costs shall be reimburse to the Engineer by the contractor or their suppliers on a Time/Material bases. This cost shall be paid on approval on disapproval of the substitution material, equipment or design.

1.26 WORKMANSHIP

- A. The installation of all work shall be made so that its several component parts will function as a workable system complete with all accessories necessary for its operation, and shall be left with all equipment properly adjusted and in working order. The work shall be executed in conformity with the best-accepted standard practice of the trade so as to contribute to efficiency and appearance. It shall also be executed so that the installation will conform and adjust itself to the building structure, its equipment and its usage.

PART 2 PRODUCTS

2.01 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch-diameter slotted holes at a maximum of 2 inches o.c., in webs.
- D. Slotted-Steel Channel Supports: Comply with Division 05 Section "Metal Fabrications" for slotted channel framing.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- G. Expansion Anchors: Carbon-steel wedge or sleeve type.
- H. Toggle Bolts: All-steel springhead type.
- I. Powder-Driven Threaded Studs: Heat-treated steel.

2.02 CONCRETE BASES

- A. Concrete: 3000-psi, 28-day compressive strength.
- B. Provide a 4" housekeeping pad under any floor mounted electrical equipment as directed by the Engineer.

2.03 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.03 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.04 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.05 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Through-Penetration Firestop Systems."

3.06 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.07 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.08 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 1. Raceways.
 2. Building wire and connectors.
 3. Supporting devices for electrical components.
 4. Electrical identification.
 5. Electricity-metering components.
 6. Concrete bases.
 7. Cutting and patching for electrical construction.
 8. Touchup painting.

3.09 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 09 Section "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.10 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

SECTION 26 05 03 - ELECTRICAL EQUIPMENT MOUNTING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical equipment mounting height requirements applicable to all Division 26 sections.

1.02 REFERENCES

- A. NECA - Standard of Installation.
- B. NFPA - National Fire Protection Association..
- C. ADA- American with Disabilities Act.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 GENERAL

- A. The mounting heights described below are the standard mounting heights. All mounting heights indicated on the drawings shall supercede the mounting heights described herein for that item only.
- B. All mounting heights are to the centerline of the item unless otherwise noted.
- C. All equipment installed in this project shall be mounted per the Americans with Disabilities Act.

3.02 MOUNTING HEIGHTS

- A. Wiring Devices
 - 1. Switches and Switch/Receptacle Combinations: 44 inches above finished floor.
 - 2. Receptacles
 - a. Standard: 18 inches above finished floor.
 - b. Above countertops: 6 inches above backsplash.
- B. Telecommunications Outlets
 - 1. Standard: 18 inches above finished floor.
 - 2. Above countertops: 6 inches above backsplash
 - 3. Wallmount: 54 inches above finished floor.
- C. Disconnect Switches
 - 1. Disconnect Switches: 60 inches above finished floor to top of enclosure.
- D. Panel Boards
 - 1. Panel boards: 72 inches above finished floor to top of enclosure; install panel boards taller than 72 inches with bottom of the enclosure, 4 inches above floor.
- E. Motor Controllers
 - 1. Motor controllers: 60 inches above finished floor to top of enclosure.
- F. Contactors
 - 1. Contactors: 60 inches above finished floor to top of enclosure.
- G. Time Clocks
 - 1. Time clocks: 60 inches above finished floor to top of enclosure

- H. Interior Luminaries
 - 1. Fixtures to be mounted at 80" minimum above finished floor to bottom of fixture:
 - a. Wall mounted luminaries protruding greater than 4 inches from wall.
 - b. Pendant mounted fixtures located above walkways.
 - 2. See electrical and architectural drawings for additional information further defining mounting height requirements.

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 CONDUCTORS AND CABLES

- A. Manufacturers:
 - 1. American Insulated Wire Corp.; a Leviton Company.
 - 2. General Cable Corporation.
 - 3. Senator Wire & Cable Company.
 - 4. Southwire Company.

- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper complying with NEMA WC 70/ICEA S-95-658. Minimum size shall be #12.
- D. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-THWN, and Type XHHW-2.
- E. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type SO with ground wire.

2.03 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. AMP Incorporated/Tyco International.
 - 3. Gardner Bender.
 - 4. Hubbell Power Systems, Inc.
 - 5. Ideal Industries, Inc..
 - 6. O-Z/Gedney; EGS Electrical Group LLC.
 - 7. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper.
- B. Branch Circuits: Copper.

3.02 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.

- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- H. Underground Feeders and Branch Circuits: Type XHHW-2, single conductors in raceway. No. 10 AWG minimum size.
- I. Branch circuit conductors installed inside light poles: Type XLP/RHW, single conductors.
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- K. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- L. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.03 INSTALLATION

- A. Do not use conductor smaller than No. 12 AWG for power and lighting circuits.
- B. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- C. All conductors and cables shall be installed in conduit, unless otherwise indicated.
- D. Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables.
- E. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- F. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- G. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. Where circuit wiring length exceeds 100 feet, increase conductor size as needed to maintain a maximum voltage drop of three percent.
- H. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- I. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

- J. Seal around cables penetrating fire-rated elements according to Division 07 Section "Penetration Firestopping."
- K. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- L. The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All single-phase branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.
- M. Conductor sizes indicated on the drawings are minimum sizes. Ampacities of conductors do not take voltage drop into consideration. Contractor shall size conductors for feeders and branch circuits to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combination of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, to provide reasonable efficiency of operation.
 - 1. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m).

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.07 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.03 SUBMITTALS

- A. Product Data: For the following:
 - 1. Ground rods.
- B. Field Test Reports: Submit written test reports to include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.
- B. Comply with NFPA 70.

1.05 COORDINATION

- A. Show location of all service grounding equipment and describe method of grounding installation. Show the following:
 - 1. Service ground conductor.
 - 2. Grounding at water meter.
 - 3. Grounding at BUS locations.
 - 4. Location of Ground Rods.
 - 5. Telephone/Data grounding equipment and conductor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Copperweld Corp.
 - b. Erico Inc.; Electrical Products Group.
 - c. Framatome Connectors/Burndy Electrical.
 - d. Galvan Industries, Inc.
 - e. Ideal Industries, Inc.
 - f. ILSCO.
 - g. O-Z/Gedney Co.; a business of the EGS Electrical Group.
 - h. Racor, Inc.; Division of Hubbell.
 - i. Superior Grounding Systems, Inc.
 - j. Thomas & Betts, Electrical, a Member of the ABB Group.

2.02 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.

- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
 - 1. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 3. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.03 CONNECTOR PRODUCTS

- A. Irreversible Compression Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type (at bus bars, equipment, and test wells only).
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
 - 1. Size: $\frac{3}{4}$ inches in diameter by 10 feet in length.

PART 3 EXECUTION

3.01 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections and irreversible Compression Connections: Use for connections to structural steel and for underground connections.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Ground Rod Clamps: Use bolted pressure clamps with at least two bolts.

- F. Grounding Bus: Install in electrical and telephone equipment rooms, whole service equipment, and elsewhere as indicated.
 - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

3.02 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
- C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- D. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- F. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.03 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrance to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

3.04 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor. Connectors must be factory filled with an oxide inhibitor. Connectors must comply with IEEE 837, UL 467 and CSA 22.2.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.05 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify architect promptly and include recommendations to reduce ground resistance.

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 1. Hangers and supports for electrical equipment and systems.
 2. Construction requirements for concrete bases.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 "Roof Accessories."

PART 2 PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube and Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. Thomas & Betts Corporation.
 - e. Unistrut; Tyco International, Ltd.
 - f.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless] steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 6. Toggle Bolts: All-steel springhead type.
 7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

- 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

- B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Boxes, enclosures, and cabinets.
- B. Related Requirements:
 - 1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for supports, anchors, and attachment components for raceways, boxes, enclosures, and cabinets.
 - 2. Section 26 27 26 "Wiring Devices" for devices installed in boxes.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. GRC: Galvanized rigid steel conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. PVC: Polyvinyl chloride.
- G. RNC: Rigid non-metallic conduit.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.05 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 2. Electri-Flex Company.
 - 3. O-Z/Gedney; a brand of EGS Electrical Group.
 - 4. Republic Conduit.
 - 5. Thomas & Betts Corporation.
 - 6. Western Tube and Conduit Corporation.
 - 7. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: compression or set-screw.
 - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

- H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. CANTEX Inc.
 - 2. CertainTeed Corp.
 - 3. Lamson & Sessions; Carlon Electrical Products.
 - 4. RACO; a Hubbell company.
 - 5. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit type and material.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman; a Pentair company.
 - 3. Square D; a brand of Schneider Electric.
 - 4. Wiegmann; Hubbell Inc.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, unless otherwise indicated, and sized according to NFPA 70.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 2. EGS/Appleton Electric.
 - 3. Hoffman; a Pentair company.
 - 4. O-Z/Gedney; a brand of EGS Electrical Group.
 - 5. RACO; a Hubbell Company.
 - 6. Spring City Electrical Manufacturing Company.
 - 7. Thomas & Betts Corporation.
 - 8. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Metal Recessed Floor Boxes: Cast metal, fully adjustable, rectangular.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions:
 - 1. Single-gang box: 4 inches by 2-1/8 inches by 2-1/8 inches deep.
 - 2. Double-gang box: 4 inches square by 2-1/8 inches deep.
 - 3. Three-gang box: 4-1/2 inches by 8-5/8 inches by 2-1/2 inches deep.
- K. Gangable boxes are prohibited.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Metal Enclosures, Type 4: Stainless steel.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

B. Minimum Raceway Size: 1/2-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Conduit: Use threaded rigid steel conduit fittings with bushings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings with insulated throat. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

- C. Complete raceway installation before starting conductor installation. Install temporary closures to prevent foreign matter from entering raceways.
- D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise noted.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated.
- I. Install exposed conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT or GRC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
1. Install in each run of aboveground GRC, IMC, and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires; use a maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement, and for all transformers and motors.
 - 1. Use LFMC in damp or wet locations.
 - 2. Install a separate ground conductor within all flexible conduit connections.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel. Horizontal distance shall not be less than 24 inches.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.

3.03 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.04 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.03 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 PRODUCTS

2.01 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on white field.
 - 2. Legend: Indicates voltage and service.
- B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.
- C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- E. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend indicating type of underground line.

- F. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

2.02 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
- C. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.03 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: According to color-coding.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Color Coding Raceways: Color-code exposed and accessible raceways of the systems listed below:
 - 1. Apply the following colors to the systems listed below:
 - a. Video Surveillance System: Yellow.
 - b. Telecommunication System: Blue.

- F. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- G. Circuit Identification Labels on Boxes: Install labels externally.
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 - 2. Concealed Boxes: Plasticized card-stock tags.
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- H. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground lighting, power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- I. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder phase conductors:
 - 1. 208/120-V Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 2. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
- J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
 - 1. Legend: 1/4-inch- steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 - 2. Tag Fasteners: Nylon cable ties.
 - 3. Band Fasteners: Integral ears.

- K. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- L. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- M. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch- high lettering on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high. Use black lettering on white field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures.
 2. Access doors and panels for concealed electrical items.
 3. Disconnect switches.
 4. Enclosed circuit breakers.
 5. Motor starters.
 6. Push-button stations.
 7. Contactors.
 8. Dimmers.
 9. Control devices.
 10. Inverters.
 11. Telephone switching equipment.
 12. Video Surveillance System main control panel
 13. PA system head-end equipment control panel.

SECTION 26 05 73 - OVERCURRENT PROTECTIVE DEVICE COORDINATION AND ARC FLASH HAZARD ANALYSIS STUDY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.
 - 1. Coordination of series-rated devices is permitted where indicated on Drawings.
- B. This Section includes an Arc Flash Hazard Analysis Study per the requirements set forth in the current version of NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 – 2002, the IEEE Guide for Performing Arc-Flash Calculations.

1.03 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals [shall] [may] be in digital form.
 - 1. Coordination-study input data, including completed computer program input data sheets.
 - 2. Study and Equipment Evaluation Reports.
 - 3. Coordination-Study Report.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For coordination-study specialist.
- B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

1.05 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

- B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.

PART 2 PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CGI CYME.
 - 2. EDSA Micro Corporation.
 - 3. ESA Inc.
 - 4. Operation Technology, Inc.
 - 5. SKM Systems Analysis, Inc.

2.02 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
 - 1. Optional Features:
 - a. Arcing faults.
 - b. Simultaneous faults.
 - c. Explicit negative sequence.
 - d. Mutual coupling in zero sequence.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.02 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support coordination study:
 1. Product Data for overcurrent protective devices specified in other electrical Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Impedance of utility service entrance.
 3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Circuit-breaker and fuse-current ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - e. Motor horsepower and code letter designation according to NEMA MG 1.
 4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Ratings, types, and settings of utility company's overcurrent protective devices.
 - e. Special overcurrent protective device settings or types stipulated by utility company.
 - f. Time-current-characteristic curves of devices indicated to be coordinated.
 - g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
 - h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
 - i. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.03 FAULT-CURRENT STUDY

- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 - 1. Distribution panelboard.
 - 2. Branch circuit panelboard.
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.
 - 1. Transformers:
 - a. ANSI C57.12.10.
 - b. ANSI C57.12.22.
 - c. ANSI C57.12.40.
 - d. IEEE C57.12.00.
 - e. IEEE C57.96.
 - 2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
 - 3. Low-Voltage Fuses: IEEE C37.46.
- E. Study Report:
 - 1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
- F. Equipment Evaluation Report:
 - 1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
 - 3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.04 COORDINATION STUDY

- A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
 - 1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
 - 2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
 - 3. Calculate the maximum and minimum ground-fault currents.
- B. Comply with IEEE 241 recommendations for fault currents and time intervals.
- C. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
 - 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 - 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

- a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
- F. Completed data sheets for setting of overcurrent protective devices.

3.05 OVERCURRENT PROTECTIVE DEVICE SETTING

- A. Manufacturer's Field Service: Engage a factory-authorized service representative, of electrical distribution equipment being set and adjusted, overcurrent protective devices within equipment.
- B. Testing: Perform the following device setting and prepare reports:
 - 1. After installing overcurrent protective devices and during energizing process of electrical distribution system, perform the following:
 - a. Verify that overcurrent protective devices meet parameters used in studies.
 - b. Adjust devices to values listed in study results.
 - 2. Adjust devices according to recommendations in Chapter 7, "Inspection and Test Procedures," and Tables 10.7 and 10.8 in NETA ATS.

3.06 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2009, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04).
- B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (panelboards) where work could be performed on energized parts.
- C. Circuits 240V or less fed by single transformer rated less than 125 kVA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E.
- D. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.
- G. The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
- H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
 - 1. Fault contribution from induction motors should not be considered beyond 5 cycles.
- I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.
- J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

- M. Provide the following:
1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
 2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
 3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

3.07 ARC FLASH LABELS

- A. Provide a 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The labels shall be designed according to the following standards:
1. UL969 – Standard for Marking and Labeling Systems.
 2. ANSI Z535.4 – Product Safety Signs and Labels.
 3. NFPA 70 (National Electric Code) – Article 110.16.
- C. The label shall include the following information:
1. System Voltage.
 2. Flash protection boundary.
 3. Personal Protection Equipment (PPE) category.
 4. Arc Flash Incident energy value (cal/cm²).
 5. Limited, restricted, and prohibited Approach Boundaries.
 6. Study report number and issue date.
- D. Labels shall be printed by a thermal transfer type printer, with no field markings.
- E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:
1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
 2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
 3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.
- F. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

3.08 ARC FLASH TRAINING

- A. The vendor supplying the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent. The trainer shall be an authorized OSHA Outreach instructor.
- B. The vendor supplying the Arc Flash Hazard Analysis shall offer instructor led and online NFPA 70E training classes.

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Outdoor and indoor photoelectric switches.
 - 2. Switch-box occupancy sensors.
 - 3. Indoor occupancy sensors.
 - 4. Multipole contactors.
 - 5. Emergency Lighting Bypass Relay
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.

1.03 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
 - 2. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.06 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and partition assemblies.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.03 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers:
 - 1. Intermatic, Inc.
 - 2. Paragon Electric Co.
 - 3. TORK.
- B. Description: Solid state, with DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; and complying with UL 773.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
 - 2. Time Delay: 15-second minimum, to prevent false operation.

3. Lightning Arrester: Air-gap type.
4. Mounting: Twist lock complying with IEEE C136.10, with base. Provide with stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

2.04 INDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers:

1. Intermatic, Inc.
2. Lithonia Lighting.
3. MicroLite Corporation.
4. Paragon Electric Co.
5. Square D.
6. TORK.
7. Touchplate Technologies, Inc.
8. Watt Stopper (The).

B. Ceiling-Mounting Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
3. Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on and off cycles.

C. Skylight Photoelectric Sensors: Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight, facing up at skylight; with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
3. Light-Level Monitoring Range: 1000 to 10,000 fc, with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on and off cycles.

2.05 SWITCH-BOX OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. Lithonia Lighting.
 - 2. Hubbell Building Automation, Inc.
 - 3. TORK.
 - 4. Hubbell Wiring Devices.
 - 5. Watt Stopper.
- B. Description: Dual-Technology type shall detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage with integral power-switching contacts rated for 800 W at 120-V ac, suitable for fluorescent light fixtures with magnetic or electronic ballasts; and rated for 1000 W at 277-V ac, suitable for fluorescent light fixtures with magnetic or electronic ballasts minimum. Unless otherwise indicated or if it is the only means of control in the area, the occupancy sensor shall function as a vacancy sensor turning luminaires off when space is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 1. Include ground wire.
 - 2. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keeps lighting off when selected lighting level is present.

2.06 INDOOR OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. Lithonia Lighting.
 - 2. Hubbell Building Automation, Inc.
 - 3. Hubbell Wiring Devices.
 - 4. Watt Stopper.
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keeps lighting off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.07 MULTIPOLE CONTACTORS

- A. Manufacturers:
1. Cutler-Hammer; Eaton Corporation.
 2. GE Industrial Systems; Total Lighting Control.
 3. Square D.
- B. Description: Electrically operated and electrically held, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Control-Coil Voltage: Match control power source.

2.08 EMERGENCY LIGHTING BYPASS RELAY

- A. Manufacturers:
1. LVS
 2. Leviton
 3. Wattstopper
- B. General Description: Ceiling mounted emergency power control device that can convert and control up to 20 regular light fixtures to approved emergency lights. Device shall be UL 924 listed emergency power control device.

1. Operation: Device is equipped with an automatic diagnostic feature that is initiated when the room switch is turned off. This test procedure will turn the emergency luminaires on for at least 2 seconds, indicating that an emergency power source is available and that the device, ballast and lamp are all functioning correctly. At all other times the room switch operates normally by turning both regular and emergency luminaires on at the same time. During a local or general power failure, the emergency fixtures will illuminate automatically, regardless of room switch on or off position, conforming to all life safety codes.
2. Device is a manufactured control equipped with an integral manual test switch, high voltage surge protection and LED indicators that denote the presence of emergency power (red LED) and utility power (green LED).
3. Load Rating: 20A at 120V or 277V Tungsten: 1800W at 120V, 1500W at 277V, HP rating: 1HP; Ambient Temperature Rating: 32 degrees F to 140 degrees F. General use 20 Amp.
4. Mounting: Device is mounted in the ceiling in the controlled space, in a manner that readily exposes LED's and test switch to inspection, without requiring removal of ceiling tile, covers, or other obstructions.
5. Warranty: 5 years.

2.09 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.01 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
- B. Label time switches and contactors with a unique designation.

3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing sensors and contactors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date from Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.

1.04 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective devices, transient voltage suppression devices, accessories, and components indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

- E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Protection Div.
 - c. Square D.

2.02 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 - 1. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

2. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 3. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- C. Conductor Connectors: Suitable for use with conductor material.
1. Main and Neutral Lugs: Mechanical type.
 2. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- D. Service Entrance Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.03 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.04 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit Breaker.
- C. Branch Overcurrent Protective Devices:
1. For Circuit Breaker Frame Sizes 125A and Smaller: Bolt-on circuit breakers.
 2. For Circuit Breaker Frame Sizes Larger Than 125A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.05 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.06 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
 - 2. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 3. GFCI Circuit Breakers: Single- and two-pole configurations with 5-30mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.07 SURGE PROTECTION DEVICE

- A. Listed and Component recognized according to UL 1449 to include Section 37.3 highest fault current category. SPD devices shall be UL 1283 listed.
- B. Provide surge current diversion paths for all modes of protection: I-N, L-G, and N-G in WYE systems.
- C. Modular in design. Each mode, including N-G, shall be fused with a 200kAIR UL-classified surge-related fuse and incorporate a thermal cutout device.
- D. Provide audible diagnostic monitoring by way of audible alarm. Alarm shall activate upon a fault condition. Provide push-to-test switch, and alarm on/off switch to silence alarms.
- E. If a dedicated breaker for SPD is not provided, the SPD shall include a UL-classified disconnect switch.
- F. Meet or exceed the following criteria:
 - 1. Minimum surge current capability (single pulse rated) per phase. 160 kA.
 - 2. UL 1449 suppression voltage rating, voltage L-N, L-G, N-G 208Y/120V; 400V.
- G. EMI/RFI Filtering: Minimum -50dB at 100 kHz with insertion ration of 50:1 using MIL-STD-220A methodology.
- H. Provide with one set of NO/NC dry contacts.

- I. Accessories:
 - 1. Six digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125V.
 - 2. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
 - 3. Audible alarm activated on failure of any surge diversion module.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Install overcurrent protective devices and controllers.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section " Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.03 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 7-1/2 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.05 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Single and duplex receptacles, ground-fault circuit interrupters, weather resistant receptacles.
 - 2. Single-, double-pole, 3-way and 4-way toggle switches and dimmer switches.
 - 3. Device wall plates.
 - 4. Floor service outlets.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.
- D. RFI: Radio-frequency interference.
- E. UTP: Unshielded twisted pair.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.06 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Cooper Wiring Devices.
 - b. Hubbell Incorporated; Wiring Device-Kellems.

- c. Leviton Mfg. Company Inc.
- d. Pass & Seymour/Legrand
- 2. Floor Service Outlets:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Pass & Seymour/Legrand; Wiring Devices Div.
 - c. Wiremold Company (The).
 - d. Steel City; Thomas & Betts Corporation.

2.02 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Heavy-Duty Specification Grade. Comply with NEMA WD 1, NEMA WD 6, Fed. Spec. W-C-596G, and UL 498.
- B. GFCI Receptacles: Straight blade, Heavy-Duty Specification Grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter.
- C. Weather Resistant Receptacles: Straight blade, Extra Heavy-Duty Specification Grade, weather resistant, comply with NEMA WD 1, NEMA WD 6, Fed. Spec. W-C-596G, NEC 406.8(A) and 406.8(B), and UL 498. Configuration NEMA 5-20R, 125V duplex receptacle listed as weather resistant type.

2.03 PENDANT CORD/CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.
 - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.04 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.05 SWITCHES

- A. Single- and Double-Pole Switches: Comply with Fed. Spec. W-C-896F and UL 20.
- B. Toggle Switches: Heavy -Duty grade, quiet type.
- C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters. Switch type shall meet ADA requirements.
 - 1. Control: Continuously adjustable slider toggle switch; with single-pole or three-way switching to suit connections.
 - 2. LED Dimmer Switches: Modular, compatible with submitted dimming LED luminaire and driver; dimmer-driver combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.06 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Wet Locations: Cast aluminum or polycarbonate, and listed and labeled for use in wet locations while "In Use."

2.07 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 5 jacks for UTP cable.

2.08 FINISHES

- A. Color:
 - 1. Wiring Devices: Ivory, unless another color is selected by architect, or required by NFPA 70.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Wrap wiring devices with insulating tape before installing and placing plates.
- C. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- D. Remove wall plates and protect devices and assemblies during painting.
- E. All 15- and 20-ampere, 125- and 250-volt nonlocking receptacles installed in damp and wet locations shall be a listed weather-resistant type.
- F. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.
- G. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.
- H. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

3.02 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use durable wire markers or tags inside outlet boxes and on the back of wall plates.

3.03 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

SECTION 26 28 13 - FUSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes cartridge fuses, rated 600 V and less, for use in enclosed switches and controllers.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Provide fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

1.04 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.05 COORDINATION

- A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.; Bussmann Div.
 - 2. Eagle Electric Mfg. Co., Inc.
 - 3. Ferraz Shawmut, inc.
 - 4. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Motor Branch Circuits: Class RK5, time delay.
- B. Other Branch Circuits: Class RK5, time delay.
- C. Control Circuits: Class CC, fast acting.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.04 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
 - 1. Motor and equipment disconnecting means.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
 - 2. Division 26 Section "Fuses" for fusible devices.

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

1.04 SUBMITTALS

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

- B. Shop Drawings: For each switch and circuit breaker.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Current and voltage ratings.
 - c. Short-circuit current rating.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Field Test Reports: Submit written test reports and include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Manufacturer's field service report.
- E. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 01. In addition to requirements specified in Division 01 Section "Closeout Procedures," include the following:
 - 1. Routine maintenance requirements for components.
 - 2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
 - 3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA AB 1 and NEMA KS 1.
- C. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.07 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fusible and Non-Fusible Switches:
 - a. Eaton / Cutler Hammer.
 - b. General Electric.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D Co.
 - 2. Molded-Case Circuit Breakers:
 - a. Eaton / Cutler Hammer.
 - b. General Electric.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D Co.

2.02 ENCLOSED SWITCHES

- A. Enclosed, Non-fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, lockable handle for up to two padlocks, and interlocked with cover in the closed position.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle for up to two padlocks, and interlocked with cover in the closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

2.03 ENCLOSED CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.

- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.04 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Wet or Damp Indoor Locations: NEMA 250, Type 4X, stainless steel.

2.05 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosures before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws, as specified in Division 26 Section "Identification for Electrical Systems."

3.04 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.05 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
 - 2. Test continuity of each line- and load-side circuit.
 - 3. Inspect mechanical and electrical connections.
 - 4. Verify rating of installed fuses.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, perform the following field tests and inspections and prepare test reports:
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.06 CLEANING

On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

SECTION 26 29 13 - ENCLOSED CONTROLLERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes ac general-purpose controllers rated 600 V and less that are supplied as enclosed units.
- B. Related Sections include the following:
 - 1. Division 26 Section "Fuses" for fuses to be used in combination controllers with fusible disconnect switch.

1.03 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each enclosed controller.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details.
 - b. Nameplate legends.
 - c. Short-circuit current rating of integrated unit.
 - d. UL listing for series rating of overcurrent protective devices in combination controllers.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
 - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Field Test Reports: Written reports specified in Part 3.
- D. Manufacturer's field service report.
- E. Operation and Maintenance Data: For enclosed controllers and components to include in maintenance manuals specified in Division 01. In addition to requirements specified in Division 01 Section "Closeout Procedures," include the following:
 - 1. Routine maintenance requirements for enclosed controllers and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- F. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.06 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- C. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Manual and Magnetic Enclosed Controllers:
 - a. Eaton / Cutler Hammer.
 - b. General Electric.
 - c. Siemens.
 - d. Square D Co.

2.02 MANUAL ENCLOSED CONTROLLERS

- A. Description: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.

2.03 MAGNETIC ENCLOSED CONTROLLERS

- A. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.
- B. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity. Control transformer to be provided with (2) primary and (1) secondary fuses.
- C. Combination Controller: Factory-assembled combination controller and disconnect switch.
 - 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by a nationally recognized testing laboratory.
- D. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 10 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.

2.04 ENCLOSURES

- A. Description: Flush- or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.

2.05 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Elapsed Time Meters: Heavy duty with digital readout in hours.

2.06 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

3.03 INSTALLATION

- A. See Division 26 Section "Common Work Results for Electrical" for general installation requirements.
- B. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Common Work Results for Electrical."
- C. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

3.04 IDENTIFICATION

- A. Identify enclosed controller components and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.05 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Division 26 Section "Low-Voltage Electric Power Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.

- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
 - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
 - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.06 CONNECTIONS

- A. Conduit installation requirements are specified in Division 26 Section "Raceways and Boxes for Electrical Systems."
- B. Ground equipment.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.07 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed controller bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: Perform the following field tests and inspections, and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection indicated in NETA ATS, Sections 7.5, 7.6, and 7.16.
 - 2. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.08 CLEANING

- A. Clean enclosed controllers internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.09 STARTUP SERVICE

- A. Verify that enclosed controllers are installed and connected according to the Contract Documents.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- C. Complete installation and startup checks according to manufacturer's written instructions.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain enclosed controllers and variable-frequency drives.
 - 1. Train owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures."
 - 3. Review data in maintenance manuals. Refer to Division 01 Section "Operation and Maintenance Data."
 - 4. Schedule training with owner, through architect, with at least seven days' advance notice.

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures with lamps and ballasts.
 - 2. Lighting fixtures mounted on exterior building surfaces.
 - 3. Emergency lighting units.
 - 4. Exit signs.
 - 5. Accessories, including fixture dimmers and occupancy sensors.

- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for manual light switches and manual wall-box dimmers for incandescent lamps.
 - 2. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

- A. CRI: Color rendering index.
- B. CCT: Correlated color temperature.
- C. CU: Coefficient of utilization.
- D. LPW: Lumens per watt, system efficacy.
- E. RCR: Room cavity ratio.
- F. LED: Light emitting diode.
- G. L70: Lumen depreciation to 70% of initial lumen output.

1.04 SUBMITTALS

- A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of fixture, including dimensions and verification of indicated parameters.
 - 2. Emergency lighting unit battery and charger.
 - 3. Complete fixture catalog number designation.
 - 4. LED:
 - a. CCT, CRI
 - b. Delivered lumen output
 - c. Driver
 - 1) Drive current
 - d. LPW
 - e. Photometric data
- B. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures," include the following:
 - 1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.

- E. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.06 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, and partition assemblies.
- B. Coordinate luminaire with submitted ceiling system for appropriate mounting accessory(s).

1.07 WARRANTY

- A. Special Warranty for Emergency Lighting Unit Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- B. Special Warranty for LED drivers: Manufacturer's standard form in which driver manufacturer agrees to repair or replace drivers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Driver: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.02 FIXTURES AND COMPONENTS, GENERAL

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- F. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is scheduled.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- G. For all luminaires provide the product specified in the lighting schedule or an equal product, subject to design team's acceptance.

2.03 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: Light-emitting diodes (LED), 70,000 hours minimum of rated lamp life.
 - 2. No greater than 5 input watts per face.

- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Light-emitting diodes (LED), 70,000 hours minimum of rated lamp life.

2.04 EMERGENCY LIGHTING UNITS

- A. General: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life and special warranty.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Contractor shall provide ten percent of total emergency lighting units to be installed at the direction of the A/E or authority having jurisdiction.

2.05 LED LUMINAIRES

- A. Maintain color consistency and light intensity across multiple fixtures of the same designation and those with the same family.
- B. Design luminaires with heat sinking adequate such that the junction temperature of the LED's is maintained to meet the rated life as published by the LED manufacturer.

2.06 LED LIGHT SOURCES (LED PACKAGES, ARRAYS, OR MODULES)

- A. Minimum Color Rendering Index of 70.
- B. Bin LED's so that all luminaires of the same type have closely-matched color and lumen output characteristics so that they shall be within 4 Mc Adams ellipse steps.
- C. Efficacy: 50 Lumens per watt unless otherwise indicated.
- D. L70: 50,000 hours minimum.
- E. CCT: 4000-4100K.

2.07 LED POWER SUPPLY

- A. Performance Requirements:
 - 1. Operate LED's within the current limit specifications for the LED manufacturer.
 - 2. Operate at 60Hz input source and have input power factor above 90% and a minimum efficiency or 70% at full rated load of the driver.
 - 3. Provide short circuit and overload protection.
- B. Regulatory Requirements:
 - 1. Contain no PCB's (polychlorinated biphenyl)
 - 2. Comply with IEEE C.62.41-1991, Class A operation.
 - 3. Be UL1310/8750 recognized when used in conjunction with a UL listed luminaire.

2.08 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Common Work Results for Electrical" for channel- and angle-iron supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.
- D. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.
- E. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.09 FINISHES

- A. Fixtures: Manufacturers' standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

2.10 LIGHTING CONTROL DEVICES

- A. Dimming Controls: Sliding-handle type with on/off control; compatible with LED driver and having light output and energy input over the full dimming range.
- B. Light Level Sensor: Detect changes in ambient lighting level and provide dimming range of 20 to 100 percent in response to change.
 - 1. Sensor Capacity: At least 40 electronic dimming ballasts.
 - 2. Adjustable Ambient Detection Range: 10 to 100 fc minimum.

- C. Occupancy Sensors: Adjustable sensitivity and off delay time range of 5 to 15 minutes.
 - 1. Device Color:
 - a. Wall Mounted: Ivory, unless another color is selected by the architect.
 - b. Ceiling Mounted: White.
 - 2. Occupancy detection indicator.
 - 3. Ultrasonic Sensors: Crystal controlled with circuitry that causes no detection interference between adjacent sensors.
 - 4. Infrared Sensors: With daylight filter and lens to afford coverage applicable to space to be controlled.
 - 5. Combination Sensors: Ultrasonic and infrared sensors combined.

2.11 SOURCE QUALITY CONTROL

- A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.
- B. Factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
 - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- C. Suspended Fixture Support: As follows:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Continuous Rows: Suspend from cable.

3.02 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.
- F. Provide field adjustments to sensors after occupancy.

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The purpose of the grounding system is to create a low impedance path to earth ground for electrical surges and transient voltages. Lightning, fault currents, circuit switching (motors turning on and off), and electrostatic discharge are common causes of these surges and transient voltages. An effective grounding system minimizes the detrimental effects of these electrical surges, which include degraded network performance and reliability and increased safety risks.
- B. The grounding system must be intentional, visually verifiable, adequately sized to handle expected currents safely, and directs these potentially damaging currents away from sensitive network equipment. As such, grounding must be purposeful in its design and installation. Four issues require special consideration:

1. Although AC powered equipment typically has a power cord that contains a ground wire, the integrity of this path cannot be easily verified. Thus, many equipment manufacturers require grounding above and beyond that which is specified by local electrical codes, such as the National Electrical Code, etcetera. Always follow the grounding recommendations of the manufacturer when installing equipment.
2. While the building steel and metallic water piping must be bonded to the grounding system for safety reasons, neither may be substituted for the telecommunications bonding backbone (TBB).
3. Electrical continuity throughout each rack or cabinet is required to minimize safety risks. Hardware typically supplied with bolt-together racks is not designed for grounding purposes. Additionally, most racks are painted. Paint is an insulator. Unless rack members are deliberately bonded, continuity between members is incidental, and in many cases, unlikely.
4. Any metallic component that is part of the data center, including equipment, racks, ladder racks, enclosures, cable trays, etc. must be bonded to the grounding system.

1.3 DEFINITIONS

- A. Bonding – The permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.
- B. Common Bonding Network (CBN) – The principal means for affecting bonding and earthing inside a building.
- C. Ground – A conducting connection, whether intentional or incidental, by which an electric circuit or equipment is connected to earth, or to some conducting body of relatively large extent that serves in place of the earth.

1.4 WORKMANSHIP

- A. The ground system must be designed for high reliability. Therefore, the grounding system shall meet following criteria:
 1. Local electrical codes shall be adhered to.
 2. The grounding system shall comply with J-STD-607-A, IEEE Std. 1100, and the pending industry standard ANSI/TIA-942, Draft 7.0.
 3. All grounding conductors shall be copper.
 4. Lugs, HTAPs, grounding strips, and busbars shall be UL Listed and CSA Certified and made of premium quality tin-plated electrolytic copper that provides low electrical resistance while inhibiting corrosion. Antioxidant shall be used when making bonding connections in the field.

5. Wherever possible, two-hole lugs shall be used because they resist loosening when twisted (bumped) or exposed to vibration. All lugs shall be irreversible compression and meet NEBS Level 3 as tested by Telcordia. Lugs with inspection windows shall be used in all non-corrosive environments so that connections may be inspected for full conductor insertion (battery rooms are an exception where windowless lugs may be used).
6. Die index numbers shall be embossed on all compression connections to allow crimp inspection.
7. Cable assemblies shall be UL Listed and CSA Certified. Cables shall be a distinctive green or green/yellow in color, and all jackets shall be UL, VW-1 flame rated.

1.5 RELATED WORK

- A. Section 26 05 00 – Common Work Results for Electrical
- B. Section 27 05 28.33 – Conduits and Back Boxes for Communications
- C. Section 27 10 00 – Structured Cabling
- D. Section 27 11 00 – Communications Equipment Room Fittings

1.6 WORK SEQUENCE

- A. During the construction period, coordinate telecommunications grounding and operations with the architect/engineer and owner.
- B. For additional information pertaining to the sequencing of the work refer to Article 13 of the General Conditions.

1.7 SUBMITTALS

- A. Under the provisions of Division 26 and Division 01, prior to the start of work the contractor shall submit:
 1. Manufacturers Data covering all products proposed indicating construction, materials ratings and all other parameters identified in Part 2 (Products) below.
 2. Manufacturer's installation instructions.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit and record documents under provisions of Division 01.
- B. Accurately record exact sizes, locations, and quantities of cables.

1.9 QUALITY ASSURANCE

- A. The manufacturer shall be a company specializing in communication cable and/or accessories with a minimum of five years documents experience in producing cable and/or accessories similar to those specified below.
- B. The contractor shall have been in this line of business for a minimum of five years and completed four jobs of the magnitude specified in the following sections.
- C. The installing contractor shall have at a minimum one Certified Installer trained to the latest industry standards to ensure the most reliable installation available. The certified installer shall have been trained by a company that offers a minimum 15 year system warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to and receive products at the site under provisions of Division 01, General Requirements.
- B. Cable shall be stored according to manufacturer's recommendation as minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location.

PART 2 PRODUCTS

2.1 COMPONENTS, KITS, AND HARDWARE

- A. PANDUIT STRUCTUREDGROUND grounding system, kits, components, and hardware shall be used to construct the grounding/earthing system.
- B. Use PANDUIT GB4 series BICSI/J-STD-607-A telecommunications grounding busbars for the TMGB, which is ideally located at the AC service entrance. Use a PANDUIT GB2 series busbar for the TGB in each of the other telecommunications/equipment spaces throughout the building. Use PANDUIT LCC-W series lugs when connecting conductors to the TMGB and TGB.
- C. Route the TBB to each TGB in as straight a path as possible. The TBB should be installed as a continuous conductor, avoiding splices where possible.
- D. Avoid routing grounding conductors in metal conduits. If the grounding conductor must be routed through a metal conduit, bond each end of the conduit to the grounding conductor.

2.2 RACK GROUNDING

- A. Equipment and racks shall be bonded according to the methods prescribed in ANSI/TIA-942 draft 7.0, as is shown in the figure below.

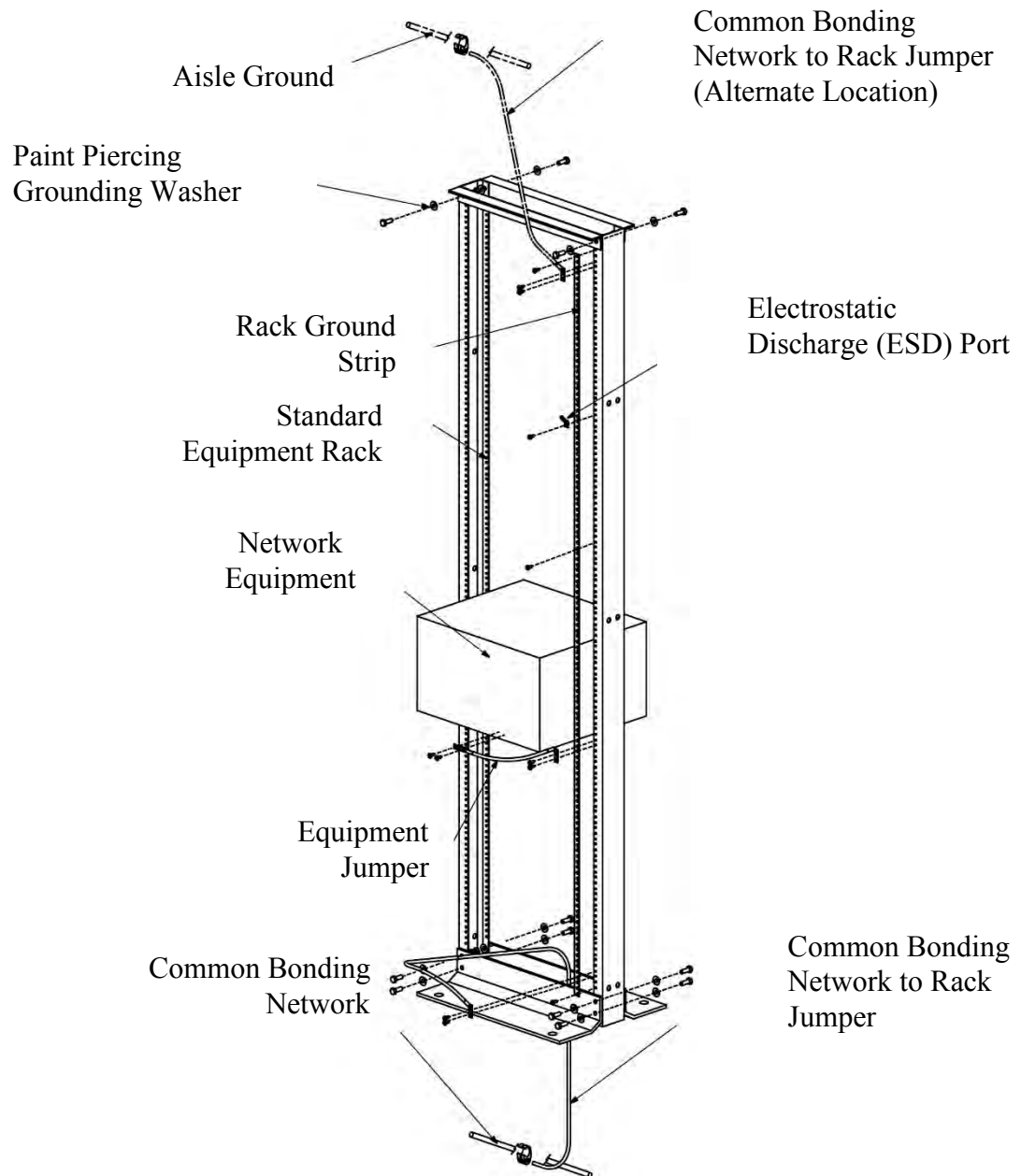


Figure 1 - Properly Grounded Rack (Back of Rack Shown)

- B. To provide electrical continuity between rack elements, PANDUIT paint piercing grounding washers, series RGW, shall be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.
- C. All racks shall utilize a full-length rack ground strip, PANDUIT part number RGS134, attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact.
- D. Mount an electrostatic discharge (ESD) port kit, PANDUIT part number RGEDS-1 directly to the rack grounding strip on the back of the rack at approximately 48 inches from the floor. Mount a second RGEDS-1 directly to the vertical mounting rail of the rack in the front at approximately the same height. Use the thread-forming screws provided to form a bond to the rack. Place the ESD protection identification stickers directly above the ESD ports.
- E. When the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. Use the appropriate PANDUIT RG series jumper for the equipment being installed and the thread-forming screws provided in the kit.
- F. Use PANDUIT part number RGCBNJ660P (Common Bonding Network to Rack Jumper) to attach the rack ground strip to the common bonding network. Do not bond racks or cabinets serially. Use the copper compression HTAP that comes with the kit to bond the conductor to the common bonding network.
- G. Patch panels will be bonded to racks using the PANDUIT bonding screws, part number RGTBS-C for racks having #12-24 equipment mounting holes, and RGTBSM6-C for racks having M6 equipment mounting holes.

PART 3 EXECUTION

3.01 GROUNDING AND BONDING

- A. The Telecommunications Grounding Busbar (TGB) in each telecommunications space will be grounded to the Telecommunications Main Grounding Busbar (TMGB) located at the service entrance. The gauge of the connecting ground cable, known as the Telecommunications Bonding Backbone (TBB) will follow J-STD-607-A guidelines, as is shown in the table below.

Sizing of the TBB	
TBB Length in Linear meters (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14-20)	4
6-8 (21-26)	3
8-10 (27-33)	2
10-13 (34-41)	1
13-16 (42-52)	1/0
16-20 (53-66)	2/0
Greater than 20 (66)	3/0

- B. The TMGB will be bonded to building steel and grounded to the electrical service ground according to BICSI TDM Manual and J-STD-607-A guidelines. Local codes may supersede these requirements. In telecommunications spaces with only one rack, the rack jumper cable can be connected directly to the TGB.

Cable Sizes for Other Grounding Applications	
Purpose	Copper Code Cable Size
Aisle grounds (overhead or under floor) of the common bonding network	#2 AWG or larger (1/0 preferred)
Bonding conductor to each PDU or panel board serving the room.	Size per NEC 250.122 and manufacturer recommendations
Bonding conductor to HVAC equipment	6 AWG
Building columns	4 AWG
Cable ladders and trays	6 AWG
Conduit, water pipe, duct	6 AWG

SECTION 27 10 00 - STRUCTURED CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This section describes the products and execution requirements relating to furnishing and installation of Telecommunications Cabling and Termination Components and related sub-systems as part of a structured cabling system. Vertical (Backbone) and horizontal (Station) cabling comprised of copper cabling are covered under this document.
- B. The Horizontal (Station) Cabling System is based on the installation of 4-Pair Unshielded Twisted Pair (UTP) DATA/VOICE (Category 6) Copper Cables. The cables shall be installed from each Standard Information Outlet (SIO) to the Telecommunications Equipment Room serving that area and terminated as specified in this document.
- C. Station cables shall be installed in conduit, in cable tray, or "free-air" above accessible ceilings. Outlets shall be mounted flush in wall-mounted box. Information Outlet locations to be identified on the project drawings.
- D. Backbone Copper Cables and Fiber Optic Cables shall link the main telephone and data network service entrance points and the Telecommunications Equipment Room. Refer to the sub-section below detailing innerduct requirements for Fiber Optic Cables.

- E. At the Main Telephone Equipment Room, termination hardware related to Voice Cabling shall be wall mounted. At the Main Data Equipment Room, data and fiber optic cable terminations shall be mounted on freestanding equipment racks.
- F. All cables and related termination, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the contractor, as detailed in the following sections.
- G. The contractor shall provide all labor and materials necessary to construct the system as described herein. This includes, but is not limited to, furnishing and installing cable, cable supports, innerduct, racking and termination components, termination, testing, labeling and documentation.
- H. Basic Electrical Requirements are applicable to all Division 27 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1.03 RELATED WORK

- A. Section 26 05 00 – Common Work Results for Electrical
- B. Section 26 05 33 – Raceways and Boxes for Electrical Systems
- C. Section 27 05 26 – Grounding and Bonding for Communications Systems
- D. Section 27 11 00 – Communications Equipment Room Fittings

1.04 REGULATORY REFERENCES

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Wisconsin Electrical Code, and present manufacturing standards. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- B. Other applicable standards are as follows:
 - 1. ANSI/IEEE C2 – National Electrical Safety Code
 - 2. NFPA 70 – National Electrical Code
 - 3. IBC – International Building Code, as adopted by the Wisconsin Commercial Building Code
 - 4. Wisconsin Administrative Code Chapter SPS 316 – Electrical
 - 5. TIA/EIA Standards 526 – 14A (OFSPT – 14), 526-7 (OFSPT – 7)
 - 6. TIA/EIA Standards 568-B, 569, and 607
 - 7. IEEE/ANSI 142 – 1982 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.

1.05 WORK SEQUENCE

- A. During the construction period, coordinate telecommunications schedule and operations with the architect/engineer and owner.
- B. For additional information pertaining to the sequencing of the work refer to Division 01, General Requirements.
- C. Installation shall be sequenced to accommodate the owner's occupancy requirements. See Division 01, General Requirements.

1.06 SUBMITTALS

- A. Under the provisions of Division 26 and Division 01, prior to the start of work the contractor shall submit:
 - 1. Manufacturers Data covering all products proposed indicating construction, materials ratings and all other parameters identified in Part 2 (Products) below.
 - 2. Manufacturer's installation instructions.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit and record documents under provisions of Division 01.
- B. Accurately record exact sizes, locations, and quantities of cables.

1.08 QUALITY ASSURANCE

- A. The manufacturer shall be a company specializing in communication cable and/or accessories with a minimum of five years documents experience in producing cable and/or accessories similar to those specified below.
- B. The contractor shall have been in this line of business for a minimum of five (5) years and completed four (4) jobs of the magnitude specified in the following sections.
- C. The installing contractor shall have at a minimum one (1) Certified Installer trained to the latest industry standards to ensure the most reliable installation available. The certified installer shall have been trained by a company that offers a minimum fifteen (15) year system warranty.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to and receive products at the site under provisions of Division 01, General Requirement.

- B. Cable shall be stored according to manufacturer's recommendation as minimum. In addition, cable must be stored in a location protected from vandalism and weather. Cable shall not be stored outside. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location.

1.10 DRAWINGS

- A. It shall be understood that the electrical and telecommunication details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the contractor in bidding the job. The contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
- B. The contractor shall verify all dimensions at the site and be responsible for their accuracy.
- C. Prior to submitting the bid, the contractor shall call the attention of the Engineer to any materials or apparatus the contractor believes to be inadequate and to any necessary items of work omitted, within ten (10) days prior to the Bid Due Date.

PART 2 PRODUCTS

2.01 BACKBONE (RISER AND TIE) COPPER CABLING

- A. Backbone Voice Cabling
 - 1. The Voice Backbone Cable shall link the main telephone service entrance demarcation point with the Main Equipment Room serving the building. This cable shall be terminated on 110 type blocks.
 - 2. Voice Backbone Cable shall incorporate 24 AWG solid annealed Copper Conductors insulated with a polyvinyl chloride skin over expanded polyethylene. Conductors shall be twisted to form pairs and fully color-coded.
 - 3. The Voice Backbone Cable shall be sized as detailed in Part 3 "Execution" of this section.
 - 4. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of ten (10) distinctive colors to identify 25 pairs according to ICEA S-80576. Marking of each mate of primary conductor in a pair with the color of that primary conductor is optional.
 - 5. The Voice Backbone Cable shall meet or exceed the EIA/TIA Category 6 performance.
 - 6. When cables of larger than 25 pairs are required, the core shall be assembled into 25-pair sub-units, each color-coded according to ICEA S-80-576. Cables with over 600 pairs shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow and violet. Binder color code integrity shall be maintained wherever cables are spliced.

7. This cable shall meet or exceed NEC Article 800 Type CMR and be UL listed. Jacket shall be of fire resistant PVC. If this cable is installed in a Plenum area it shall meet or exceed NED Article 800 Type CMP and be UL listed.
8. All cables and equipment shall be furnished, installed, wired and tested by the contractor.

2.02 BACKBONE FIBER OPTIC CABLE

A. General

1. Cables shall incorporate optical fibers meeting the specifications detailed in the sub-section(s) below. Backbone Fiber Optic Cable sizing (fiber count) shall be per Project Drawings.

B. Backbone Fiber Optic Cable

1. This cable shall be suitable for installation free-air, in building risers, in conduit, in cable tray and/or in innerduct.
2. Cable materials shall be all dielectric (no conductive materials).
3. Cabling shall carry OFNR rating (Optical Fiber Non-Conductive Riser) when installed in conduit and shall be listed as being suitable for use in a vertical run shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. An acceptable method of defining fire-resistant characteristics shall be that the cable passes the requirements of the Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts (ANSI/UL 1666).

C. Outer Sheath

1. The Outer Sheath shall be marked with the manufacturer's name, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every two feet.

D. Temperature Range

1. Storage: -40 to +70 degrees C (no irreversible change in attenuation)
2. Operating: -20 to +70 degrees C (OFNR)

E. Humidity Range: 0 to 100%

F. Max. Tensile Load (> 12-fibers; Backbone Intra-building)

1. During Installation: 1332 Newton's (300 lb. force) (no irreversible change in attenuation)
2. Long Term: 600 N (135 lb. force)

G. Bending Radius

1. During Installation: 20 times cable diameter
2. No Load: 10 times cable diameter

- H. Optical Fiber Specifications (General)– Backbone Cable
 - 1. The fiber count in each cross-section will vary. For quantities and other design information, refer to the Project Drawings and Execution Section.
 - 2. All optical fibers shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification. Factory optical fiber splices are not allowed.
 - 3. All fibers shall have been subjected to a minimum tensile proof test by the fiber manufacturer equivalent to 100-kpsi.
 - 4. All fibers in each cable shall be guaranteed to meet the stated specifications.
- I. Multi-mode Optical Fibers
 - 1. Multi-mode Optical Fibers in each cable shall meet the following specifications:
 - a. Fiber Type Multi-mode; doped silica core surrounded by a concentric glass cladding
 - b. Index Profile Graded Index
 - c. Transmission Windows 850-nm and 1300-nm
 - d. Core Diameter (nom) 50- μ m (microns) $\pm$ 3
 - e. Cladding Diameter 125- μ m $\pm$ 2
 - f. Core –clad Concentricity < 3- μ m
 - g. Cladding Non-circularity <2.0%
 - 2. Fiber Coating Diameter 250 - μ m $\pm$ 15 (primary coating)
 - a. All coatings shall be mechanically strippable without damaging the optical fiber.
 - 3. Attenuation (max. @ 23 $\pm$ 5 degrees C; Backbone)
 - a. @ 850-nm 3.75-dB/km
 - b. @ 1300-nm 1.5-dB/km
 - 4. Changes to multi-mode fiber shall show a point of discontinuity greater than 0.2dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that fiber by the owner.
 - 5. Bandwidth (min.)
 - a. @850-nm 200MHz*km
 - b. @1300-nm 500MHz*km
 - 6. No multi-mode optical fiber shall show a point discontinuity greater than 0.2 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of the fiber by the owner.

2.03 HORIZONTAL MEDIA (STATION CABLES)

- A. Horizontal Data Station Cable (Copper)
 - 1. All horizontal Data Station Cables shall terminate on modular Patch Panels in data racks in the Telecommunications Equipment Room (ER) as specified on the drawings.

2. Transmission characteristics of the Data Station Cables shall meet full Category 6 performance criteria as defined by the referenced TIA/EIA documents. Refer to the Execution Section which details the required performance criteria of the completed link of which the cable is a part.
3. Important: Cable and termination components (jack, patch panel, wiring, blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.
4. The jacket color for Data cabled shall be BLUE.
5. Cable shall be packaged in a way that minimizes tangling and kinking of the cable during installation. Examples are open reels or packages that incorporate a rotating reel.

B. Horizontal Voice Station Cable (Copper)

1. All horizontal Voice Station Cables shall terminate on modular Patch Panels in data racks in the Telecommunications Equipment Room (ER) as specified on the drawings.
2. Transmission characteristics of the Voice Station Cables shall meet full Category 6 performance criteria as defined by the referenced TIA/EIA documents. Refer to the Execution Section which details the required performance criteria of the completed link of which the cable is a part.
3. Important: Cable and termination components (jack, patch panel, wiring, blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.
4. The jacket color for Voice cabled shall be WHITE.
5. Cable shall be packaged in a way that minimizes tangling and kinking of the cable during installation. Examples are open reels or packages that incorporate a rotating reel.

2.04 INFORMATION OUTLET

A. General

1. Station cables shall each be terminated at their designated workstation location in the connector types described in the sub-sections below. Included are modular jacks (Voice and Data). These connector assemblies shall snap in to a mounting frame. The combined assembly is referred to as the Standard Information Outlet (SIO).
2. SIO mounting configurations shall be as follows:
 - a. Flush mounted in electrical outlet box.
 - b. All faceplates shall have the jacks loaded from the rear. Front-loaded faceplates will not be acceptable.
3. The Telecommunications Outlet Frame shall accommodate:
 - a. Four (4) modular jacks when installed in a wall-mounted assembly. One of the top positions shall be utilized for the voice jack and the remaining positions shall be utilized for the data jacks.
 - b. The Voice outlet shall be: 8-pin modular, Category 6, unkeyed, Fog White pinned to T568 (B) standards.

- c. The Data outlet shall be: 8-pin modular, Category 6, unkeyed, Fog White, pinned to T568 (B) standards
- d. The outlet frame shall incorporate a mechanism for adjusting the surface plate to a plumb position.
- 4. Multiple Jacks- identified in close proximity on the drawings (and not separated by a physical barrier) – may be combined in a single assembly. The contractor shall be responsible for determining the optimum compliant configuration based on the products proposed and documented these in the as-built records.
- 5. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the contractor shall submit the proposed configuration for each SIO type for review by the Engineer.
- 6. Wall Mount Outlet Faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
- 7. Where stand-alone “Data” or “Voice” only jacks are identified, the SIO Frame shall be configured as to allow for the addition of one (1) additional jack (voice or data) to be installed to supplement each such jack as defined by this project. The installation of these supplemental jacks is NOT part of this project.
- 8. Any unused jack positions shall be fitted with a removable blank inserted into the opening.
- 9. The faceplate of the SIO shall be constructed of High Impact Plastic. Faceplate color shall be Fog White.
- 10. Wall-mounted “Voice Only” outlets shall be installed where identified on the floor plan drawings to accommodate wall-mounted telephone sets. The wall plate shall be of stainless steel construction, accommodate one (1) voice jack as defined below, mount on a standard single gang outlet box or bracket and include mating lugs for wall phone mounting.
- 11. All Standard Information Outlets and the associated jacks shall be of the same manufacturer throughout the project. An allowable exception, however, is the wall-mounted “voice-only” outlet described above.

B. Data Jack

- 1. Data jacks shall be an 8-pin modular jack.
- 2. The interface between the jack and the station cable shall be a 110-style block or insulation displacement type contact. Termination components shall be designed to maintain the cable’s pair twists as closely as possible to the point of mechanical termination.
- 3. Data jacks shall be pinned per TIA-568A with pairs as follows:
 - a. Pair 1 – Pins 5 and 4
 - b. Pair 2 – Pins 3 and 6
 - c. Pair 3 – Pins 1 and 2
 - d. Pair 4 – Pins 7 and 8
- 4. Transmission characteristics of the data jack shall be as required to meet the TIA/EIA category 6 performance criteria. Refer to the Execution Section which details the required performance criteria of the completed link of which the jacks are a part.

5. The jack shall be UL verified and listed.
6. Jack contacts shall have a minimum of 50 micro-inches of gold plating.
7. The color of the Data Jack shall be Fog White.

C. Voice Jack

1. Voice jacks shall be non-keyed 8-pin Modular Jack (8P8C)
2. The interface between the jack and the station cable shall be a 110-style block or insulation displacement type contact. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
3. Voice jacks shall be pinned per T568A standard with the pairs as follows:
 - a. Pair 1 – Pins 5 and 4
 - b. Pair 2 – Pins 3 and 6
 - c. Pair 3 – Pins 1 and 2
 - d. Pair 4 – Pins 7 and 8
4. Voice termination hardware shall meet Category 6 performance specifications as defined by the referenced EIA/TIA documents.
5. The color of the voice jack shall be Fog White.

D. Wall-mount Voice-Only Outlets

1. Wall mounted "Voice Only" outlets shall be installed where identified ("W") on the Project Drawing(s) to accommodate wall-mounted telephone sets. The wall plate shall be of stainless steel construction, accommodate one (1) voice jack as previously defined, mounted on a standard single gang outlet or bracket and include mating lugs for wall phone mounting.

E. Fiber Optic Connector

1. The optical connector shall be SC-type.
2. The connector ferrule shall be ceramic or glass-in-ceramic, metallic, or equivalent. The optical fiber within the connector ferrule shall be secured with an adhesive or mechanical process to prevent pistoning and other movement of the fiber strand.
3. The connector body shall be of metal or a composite material.
4. The attenuation per mated pair shall not exceed the following values:
 - a. Multimode 0.5-dB (individual); 0.3-dB (average)
 - b. These values shall hold throughout the Cable system. Connectors shall sustain a minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.
5. The connector shall meet the following performance criteria:
 - a. Test Procedure Max. Attenuation Change
 - b. Cable Retention (FOTP-6) 0.2-dB
 - c. Durability (FOTP-21) 0.2-dB
 - d. Impact (FOTP-2) 0.2-dB
 - e. Thermal Shock (FOTP-3) 0.2-dB
 - f. Humidity (FOTP-5) 0.2-dB

2.05 TELECOMMUNICATIONS CLOSET TERMINATIONS

A. Data and Voice Patch Panels

1. Data and voice station cabling shall be terminated at the main telecommunications equipment room on patch panels incorporating modular jacks meeting the specifications for the telecommunications outlet detailed in the section above.
2. These panels shall be rack mounted.
3. The data and voice patch panels shall consist of a Mini-Com Modules for UTP. Modular jacks shall meet the specifications detailed above (NON-KEYED 8-pin).
4. Patch panel shall be Panduit Mini-Com Angled Modular Faceplate patch panels.
5. The largest single patch panel configuration shall not exceed 48 ports. Panels that are modular shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12-jacks. No "High Density" data patch panels shall be allowed. (High Density is defined as those panels having less than one inch clearance between rows of modular connectors).
6. The patch panel blocks shall have the ability to seat and cut 8 conductors (4 pairs) at a time and shall have the ability of terminating 22-through 26-gauge plastic insulated, solid and stranded copper conductors. Patch panel blocks shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
7. The patch panel as a system (including jack, cable interface and intermediate components) must maintain Category 6 performance per the referenced EIA/TIA documents. All pair combinations must be considered, with the worst-case measurement being the basis for compliance.
8. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.
9. The patch panel shall have color coded designation strips to identify cable count.
10. Transmission performance shall be maintained by the patch panel as a system (including jack, cable interface and intermediate components).

B. Voice Termination Field

1. At the telecommunications equipment room, each voice "backbone" cable shall be terminated on high-density horizontal blocks.
2. Each horizontal row of the cross-connect block must be capable of terminating one (1) twenty-five pair binder group (Backbone Cables). Backbone and Station blocks shall be segregated clearly identifying their function.
3. The mechanical termination shall:
 - a. Have the ability of terminating 22-26 AWG plastic insulated, solid and stranded copper conductors.
 - b. Provide a direct connection between the cable and jumper wires.

- c. Have less than 0.2-dB of attenuation from 1-16MHz.
 - d. Have less than 100mw of DC resistance.
 - e. Have less than 5 mw of resistance imbalance.
 - f. Have minimal signal impairments at all frequencies up to 16MHz.
- 4. Blocks shall identify pair position by a color designation-Blue, Orange, Green, Brown, Slate (Backbone only).
- 5. The blocks shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
- 6. The voice termination hardware shall be 110-style.
 - a. Voice station cabling termination
 - 1) Four (4) pair termination clips (e.g. C4) shall be used in the termination of voice station cabling.
 - b. Voice backbone cabling termination
 - 1) Five (5) pair termination clips (e.g. C5) shall be used in the intermediate termination of voice backbone cabling.
- 7. Horizontal troughs incorporating plastic distribution rings shall be provided by the contractor to accommodate routing of jumpers. Troughs shall be positioned at the top of each column of termination blocks and between each 100-pair wiring block.
- 8. Vertical troughs incorporating metal distributing rings shall be provided in the Entrance Room for vertical routing of jumper and/or cross-connect wire. In each telecommunication closet, a backboard incorporating plastic distribution rings allowing for a change in direction in cross connect wiring shall be installed between the blocks on which station and backbone cabling are terminated.

2.06 FIBER OPTIC PATCH PANELS

- A. All terminated fibers shall be mated to Duplex SC couplings mounted on enclosed patch panels. Couplers shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types including SC, ST, Fixed Shroud Duplex (e.g. "FDDI Connector"), Bionic and FC by changing panels on which connector couplings are mounted.
- B. At each TC these panels shall be rack mounted.
- C. The patch panel enclosure shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings – including those not terminated (if applicable). Connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated shall be furnished and installed by the contractor, and/or those included in "Bid Alternates" (if applicable).
- D. Patch panels shall be enclosed assemblies affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to protect the connector couplings and fiber optic jumpers.

- E. The patch panel enclosures shall provide for strain relief of incoming cables and shall incorporate radius control mechanisms to limit bending of the fiber to the manufacturers recommended minimums or 1.2 inch, whichever is larger.
- F. Access to the inside of the patch panel enclosure during installation shall be from front and/or rear. Panels that require any disassembly of the cabinet to gain entry will not be accepted.
- G. All patch panels shall provide protection to both the “facilities” and “user” side of the coupling. The patch panel enclosure shall be configured to require front access only when patching. The incoming cables (e.g. Backbone, Riser, etc.) shall not be accessible from the patching area of the panel. The enclosure shall provide a physical barrier to access of such cables.
- H. Where “Loose Buffered” cables are installed, the 250 µm coated fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies (“pigtailed”) or (2) the use of a “fan-out” kit. In the latter approach, individual fibers are to be secured in a protective covering- an Aramid reinforced tube for example-with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and sub-assemblies are secured to prevent damage. Splicing shall be by the “Fusion” method. Individual splice loss shall not exceed 0.3dB for multi-mode fibers. Direct termination of 250 µm coated fibers shall not be permitted.
- I. Where splicing of the cabling at system end points is a requirement of the installation, the Termination Enclosure shall incorporate a mechanism for securing the splice tray(s) and fiber slack. The splice tray and fiber slack shall not be accessible from the “user” side of the enclosure.

2.07 EQUIPMENT CABINET

- A. Equipment Cabinet (Wall Mount)
 - 1. Where identified on the drawings, wall mounted equipment racks shall house all termination components installed under this contract.
 - a. Be of a “two section” construction including (1) wall-mount section, and (2) drilled and tapped rail sections. Each section shall be hinged to facilitate access. Hinges shall be configurable to open LEFT OR RIGHT.
 - b. Shall accommodate standard 19 inch mounting for patch panels and electronics.
 - c. Hardware mounting depth (from front of channel upright to wall) shall be 12-inches.
 - d. Shall have a load-bearing capacity of 100 lbs or greater.
 - 2. The cabinets shall be constructed of painted steel or aluminum and offer a minimum usable mounting height of 12 RU (RU= 1 ¾ inch) and be a minimum of 12 inches deep. Access to the rear of the rack-mounted equipment shall be by a hinged arrangement.

3. The rack shall be spaced to accommodate industry standard 19-inch mounting and tapped to accept 12-24 screws.
4. Racks shall be equipped with vertical and horizontal cable management hardware, in the form of rigs and guides, as to allow an orderly routing of optical fiber and twisted pair jumpers from the patch panel to the customer provided network equipment. At a minimum, one such horizontal jumper management panel shall be provided with each cabinet. Jumper management panels shall be 3 ½ inch in height and have a minimum of five (5) jumper distribution rings.
5. Each rack shall be supplied with a minimum of twelve (12) releasable (e.g. “hook and loop”) cable support ties and shall be supplied with a supply of spare screws (minimum of 24).

2.08 FLEXIBLE NONMETALLIC INNERDUCT AND FITTINGS

A. General

1. Flexible non-metallic innerduct (e.g. “Innerduct”) shall be used as follows:
 - a. to segment conduit(s), increasing their capacity.
 - b. as protection to fiber optic cables(s) within equipment rooms and telecommunications closets and the path between them.
2. Innerduct shall be corrugated.
3. Where not installed in a continuous length, innerduct segments should be spliced using couplings designed for that purpose.
4. Any vacant innerduct shall be equipped with a pull cord and capped at all ends to inhibit the entry of water and contaminants.
5. Nominal duct size shall be 1-inch (minimum).
6. Innerduct should be rated (e.g. General, Flame-retardant, Riser or Plenum) as required by the installation environment. Riser and Plenum innerduct shall be of a color contrasting to that of the “Standard” and Flame-retardant innerduct. The preferred colors are Orange (“Standard and Flame retardant) and White (Riser and Plenum).

B. Flame-retardant Innerduct

1. Innerduct installed within buildings (not including riser paths) shall meet all of the above General requirements plus:
 - a. Shall be fabricated of flame-retardant materials suitable for installation in such environments.
 - b. Meet or exceed all requirements for flame propagation as specified by test method UL-2004 and referenced by the National Electrical Code NEC Sections 770 and 800 for listed optical fiber raceways being installed in plenum air spaces.

2.09 MISCELLANEOUS MATERIALS

A. Surface Raceway

1. It is NOT anticipated that surface raceway may be used in this project.

- B. Telecommunications Ground
 - 1. At the telecommunications equipment room and at the electrical service entry, the contractor shall install a “Telecommunications Grounding Busbar (TGB)”.
- C. Labels
 - 1. All labels shall be permanent and machine generated.

PART 3 EXECUTION

3.01 GENERAL

- A. Contractor shall furnish and install all cables, connectors and equipment as shown on drawings and as specified above. It shall be noted that all cables shall be installed in continuous lengths from endpoint to endpoint. No splices shall be allowed unless noted otherwise.
- B. Provide cable routing as required between termination points.
- C. It is the contractor’s responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring
- D. Beginning installation means contractor accepts existing conditions.
- E. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include, but not limited tom sheaves, winches, cable reels, cable reel jackets, duct entrance tunnels, pulling tension gauge and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling had begun. Makeshift devices, which may move or wear in a manner to pose a hazard to the cable, shall not be used.
- F. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a “break - away” or other approved method.
- G. All damage to interior spaces caused by the installation of cable, raceway or other hardware shall be repaired by the contractor. Repairs shall match color and finish of walls, floors, and ceilings. Any contractor-damaged ceiling tiles are to be replaced, at no cost to the owner, to match color, size, style and texture.
- H. Where unacceptable conditions are found, the contractor shall bring this to the attention of the architect and owner immediately. A written resolution will follow to determine the appropriate action to be taken.

- I. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.
- J. Cable pulling shall be done according to cable manufacturer's recommendations and ANSI/IEEE C2 standards. Manufacturer's recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed. If any installed cable is kinked to a radius less than recommended dimension it shall be replaced by the contractor with no additional cost to the project.
- K. All wiring shall be run "free-air" above accessible ceilings, or in conduit raceway. All cable shall be free of tension at both ends.
- L. Avoid abrasion and other damage to cables during installation.
- M. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.
- N. The cable system will be tested and documented upon completion of the installation as defined in the section below.
- O. A pull cord (nylon; 1/8 inch minimum) shall be co-installed with all cable in any conduit.

3.02 SYSTEM TOPOGRAPHY AND CABLE SIZE REQUIREMENTS

- A. Backbone Cabling (Riser and Tie)
 - 1. Backbone cables shall be installed to link telecommunications rooms.
- B. Voice Backbone Cabling
 - 1. Backbone voice cabling shall be sized based on minimum pair counts (The pair counts shall include 30% growth to the nearest cable size). Cabling is to be terminated on 110-type blocks. The contractor shall bond the outer metallic sheath of the cable to the TGB using a #6 AWG solid copper wire. This shall be as close as practical to the Building Entrance ground as defined by applicable code.
- C. Fiber Optic Backbone
 - 1. Fiber optic backbone cabling shall be sized based on fiber counts as outlined on project drawings. Cabling is to be terminated on patch panels.
- D. Fiber Optic Cable Installation
 - 1. Cable slack shall be provided in each Backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from

damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure. Slack required in the various subsystems is as follows:

- a. Backbone Intra-Building: A minimum of 5-meters (approx 15-feet) of slack (each cable if applicable) shall be coiled and secured at one (1) end – preferably at the Entrance Room and/or Main Equipment Room. Cable slack installed other than at each end of cable run shall not be allowed.
- b. Exact cable termination locations shall be field verified with owner.
- c. Where exposed, all backbone fiber optic cable shall be installed in protective innerduct. The innerduct should extend into the termination and/or storage enclosure(s) at system endpoints.

E. Station Cabling

1. Information outlet cables with copper media (voice and data UTP) shall be located as detailed on the project drawings.
2. Station cables shall run to the information outlet from the telecommunications closet serving each area in conduit and free-air above drop ceilings.
3. The maximum station cable drop length for data UTP shall not exceed 295-feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The contractor is responsible for installing station cabling in a fashion as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Engineer prior to installation. Changes to the plan shall be approved by the Engineer.
4. All cables shall be installed splice-free unless otherwise specified.
5. During pulling operation an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and to operate pulling machinery.
6. Avoid abrasion and other damage to cables during installation.
7. All cables shall be free of tension at both ends. In cases where the cable must bear some stress, Kellems grips may be used to spread the strain over a longer length of cable.
8. Where installed free-air, installation shall consider the following:
 - a. Cable shall run at right angles and be kept clear of other trades work.
 - b. Cables shall be supported according to code utilizing “J-Hook” mounting rings anchored to ceiling concrete, piping supports or structural steel beams. Hooks shall be designed to maintain cables bend to larger than the minimum bend radius (typically 2 x cable diameter).
 - c. Supports shall be spaced at a maximum 4- foot interval unless limited by building construction. If cable “sag” at mid-span exceeds 6-inches, another support shall be used.
 - d. Cable shall never be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires.

- e. Cables shall not be attached to other cabling, plumbing or steam piping, ductwork, ceiling supports or electrical or communications conduit.
- 9. Manufacturers minimum bend radius specifications shall be observed in all instances.
- 10. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.
- 11. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
- 12. A coil of 4 feet in each cable shall be place in the ceiling at the last supports (e.g. J-Hook, Bridal Ring, etc.) before the cables enter a fishable wall, conduit, or box. These “service loops” shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
- 13. To reduce or eliminate EMI, the following minimum separation distances from <480V power lines shall be adhered to:
 - a. Twelve (12) inches from power lines of <5-kVa.
 - b. Eighteen (18) inches from high voltage lighting (including fluorescent).
 - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
 - d. Thirty-nine (39) inches from transformers and motors.
- 14. All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.

F. Information Outlets

- 1. Information Outlets shall be flush mounted in wall-mounted boxes.
- 2. Nominal height (from finished floor to center line of outlet) in new installation shall be as follows:
 - a. Standard Voice and Data Outlet 18 inches
 - b. Wireless Access point (WAP) 12 inches above finished ceiling
 - c. Wall-Mounted Telephone Outlet 54 inches
 - d. Wall-Mounted Telephone Outlet for Wheelchair Persons:
 - 1) Approach head on per ADA regulations
 - 2) Approach parallel per ADA regulations

G. Innerduct

- 1. Innerduct shall be riser or plenum rated as required by the installation environment. At minimum, innerduct should extend to the ladder rack above the termination enclosure at system endpoints.
- 2. All exposed innerduct is to be labeled at 35-foot (minimum) intervals with tags indicating ownership, the cable type (e.g. “Fiber Optic Cable”) and the cables it contains (e.g. MA-CS or FS-CS).
- 3. Where not installed in conduit, fiber optic cable shall be installed in protective innerduct.

4. Contractor shall determine optimum size and quantity to satisfy the requirements of the installation to ensure that the mechanical limitations – including Minimum Bend Radius – of the cable are considered.
5. The innerduct should extend into the termination enclosure at system endpoints.
6. Where not installed in a continuous length, innerduct segments should be spliced using couplings designed for that purpose.

3.03 CABLE TERMINATION

A. General

1. At the telecommunications equipment room, all data and voice station cables shall be positioned on termination hardware in sequence of the outlet I.D. starting with the lowest number.
2. At the 110-block, all intermediate voice cables shall be positioned on termination hardware in sequence of the outlet I.D. starting with the lowest number.
3. Termination hardware (blocks and patch panels) positioning and layout must be reviewed and approved by the Engineer prior to construction. The review does not exempt the contractor from meeting any of the requirements stated in this document.

B. Cable Termination – Voice UTP

1. Voice pairs shall terminate on wall mounted 110 type blocks. The Contractor shall coordinate the placement of blocks in order to integrate with other cabling.
2. Station blocks shall be provided to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation including change orders.
3. At information outlets and termination blocks, the installer shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination for voice cables. The cable jacket shall be removed only to the extent required to make the termination.
4. The contractor shall furnish and install cable management hardware (e.g. D rings and cable guides) to neatly and securely route the cable from cable tray to the cable termination hardware.
5. The height of the voice termination field shall not exceed 6-feet (72-inches) above floor level to facilitate cable maintenance.
6. Blocks on which backbone and intermediate cabling are terminated shall be positioned in separate columns. Backbone cabling should be positioned to the left; intermediate cabling to the right and be in close proximity as to simplify installation and subsequent tracing of cross-connect wiring. Where new cabling is to be integrated with existing cabling at the building entrance, it will be the responsibility of the contractor, in cooperation with the owner, to coordinate placement of voice termination hardware the local exchange carrier(s) serving the site.

7. Cables shall be fed from below the termination hardware in a manner that will facilitate growth.
8. Horizontal troughs incorporating split plastic distribution rings shall be provided by the contractor to accommodate routing of jumpers. Troughs shall be positioned at the top of each column of termination blocks and between each 100-pair wiring block. Rings shall be positioned between the backbone and station blocks for vertical routing of jumpers and/or cross connect wiring.
9. Termination of intermediate voice cabling shall be accomplished by using four-pair (e.g. C4-type) clips. The twenty-fifth pair of each row on the 110 type block located in the IDF shall not be used for termination of horizontal voice cable.
10. Termination of backbone voice cabling shall be accomplished by using five-pair (e.g. C5-type) clips.
11. The installer shall ensure that the twists in each cable pair are preserved to within 1.0 inch of the termination for all UTP cables. The cable jacket shall be removed only to the extent required to make the termination.

C. Cable Termination – Data UTP

1. Data patch panels shall be designed and installed in a fashion as to allow future station cabling to be terminated on the panel without disruption to existing connections.
2. Data patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation including change orders.
3. At information outlets and data patch panels, the installer shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

D. Cable Termination – Fiber Optic

1. ALL fibers shall be terminated using the specified connector type.
2. Fibers shall be positioned consecutively and mapped “position for position” between patch panels. There shall be no transpositions in the cabling.
3. Connectors from two cables shall never share a common coupling panel. Multi-mode and single mode optical fibers (where applicable) shall be segregated on the panels as to clearly identify the distinction between fiber types.
4. All terminated fibers at the telecommunications closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.
5. All couplings shall be fitted with a dust cap.
6. Fibers from multiple locations may share a common enclosure, however, they must be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure provided that they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g. “insert”).

7. Slack in each fiber shall be provided as to allow re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30 inch high workbench positioned adjacent to the termination enclosure(s). A minimum of 1-meter (~39 inches) of slack shall be retained regardless of panel position relative to the potential work area.
 8. Where "Loose Buffered" cables are installed, the 250µm coated fibers contained in these cables may be terminated either by 1) splicing of factory terminated cable assemblies ("pigtailed") or 2) use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering, an Aramid (e.g. Kelvar) reinforced tube for example, with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and sub assemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.3 dB for multi-mode fibers and 0.1 dB for single mode fibers (of applicable). Direct termination of 250 um coated fibers shall not be permitted.
- E. Voice Cross Connects
1. This contractor shall be responsible for the "Cross Connect" wiring between the station and backbone voice cabling.
 2. One (1) pair in each station cable shall be cross-connected to the backbone (riser or tie) cable . One pair Cross connect wire shall be used.
 3. Fastening cables directly to support brackets with wire or plastic ties will not be accepted. All cabling shall be neatly laced, dressed and supported. Retainer clips shall be used on each 110-type block to secure jumper wires on the wiring block(s).
 4. It shall be the responsibility of the contractor to work with the owner and site coordinator(s) and provide the necessary assistance to allow owner and/or telephone company personnel to make the necessary connections to establish service on the new cable system. These activities include, but are not limited to cross connect documentation, general wiring overview and cable pair identification.
- F. Equipment Cabinet (Wall Mount)
1. Equipment cabinet shall be furnished and installed by the contractor as required to facilitate the system cable terminations.
- G. Hardware.
1. Data patch panel termination hardware shall be Panduit products to include:
 - a. Patch panel Panduit #CPPLA48WBL, as required with 20% spare capacity.
 - b. Horizontal pass through Panduit #NCMHAEF4, (2) per rack.
 - c. Vertical patch cable management Panduit #WMPVHC45E one each side (2) of rack containing 48 port angled patch panels.
 2. Substitution of other brands must be approved by owner before work begins. Contractor must supply owner with substitution product catalog and product samples for approval.

3. Standard Information Outlet (SIO) hardware shall include both data and voice terminations and faceplate. Contractor must supply owner with substitution product catalog and product samples for approval.

3.04 TESTING AND ACCEPTANCE

A. General

1. The contractor is responsible to perform acceptance tests as indicated below for each sub-system (e.g. backbone, station, etc.) as it is completed.
2. The contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the contractor shall provide a summary of the proposed test plan for each cable type including equipment to use used, set-up, test frequencies or wavelengths, results format, etc. The Engineer shall approve of the method of testing.
3. The contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The contractor shall provide the owner with a written certification that this inspection has been made.
4. The contractor shall conduct acceptance testing according to a schedule coordinated with the owner. Representatives of the owner may be in attendance to witness the test procedures. The contractor shall provide a minimum of one (1) week advance notice to the owner as to allow for such participation. The notification shall include a written description of the proposed conduct of the tests including copies of blank test result sheets to be used.
 - a. **IMPORTANT:** Failure to provide the above information shall be grounds for the owner/engineer to reject any and all Documentation of Results on related testing and to require a repeat of the affected test.
5. Tests related to connected equipment of others shall only be done with the permission and presence of the contractor involved. The contractor shall ascertain that testing only as required to prove the wiring connections are correct.
6. The contractor shall provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the owner, the contractor shall provide copies of the original test results.
7. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the contractor. The applicable tests shall then be repeated.
8. Should it be found by the Engineer that the materials or any portion thereof furnished and installed under this contract fail to comply with the specifications and drawings, with the respect or regard to the quality, amount of value of materials, appliances or labor used in the work, it shall be rejected and replaced by the contractor and all work distributed by changes necessitated in consequence of said defects or imperfections shall be made good at the contractor's expense.

B. Voice cabling (Copper UTP)

1. Backbone Cabling

- a. Backbone voice cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g. 110). Any mispositioned pairs shall be identified and corrected. The percentage of “bad” pairs shall not exceed 3% in any Backbone (riser or tie) cable based on total pair count. All bad pairs must be identified and documented.

2. Station Cabling

- a. Testing shall be from the Jack at the SIO voice outlet to the termination block on which the cables are terminated at the equipment room.
- b. All horizontal “Station” cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, wire map (conductor position on the modular jack). Any defective, split or mispositioned pairs must be identified and corrected.
- c. Testing of the cabling systems rated at TIA Category 6 shall be performed to confirm proper functioning and performance.
- d. In addition to the above, performance testing shall be performed on all cables. Testing of the transmission performance of station cables shall include the following:
 - 1) Length
 - 2) Attenuation
 - 3) PSNEXT Loss
 - 4) Return Loss
 - 5) PSELFEXT Loss
 - 6) Propagation Delay
 - 7) Delay Skew
 - 8) Return loss
- e. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission performance testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify “PASS” on each cable and display the specified parameters – comparing test values with standards based “templates” integral to the unit.
- f. Testing shall be per ANSI/TIA/EIA 568-B Permanent Link test; Category 6
 - 1) Important: Where cross-connection of cabling sub-systems (e.g. Station and backbone) by the contractor is specified, each subsystem shall be tested separately as defined above followed by a re-test of the interconnected system after cross connection is complete.

C. Data Station Cabling (Copper UTP)

- 1. Testing shall be from the jack at the SIO to the data patch panel on which the cables are terminated at the wiring hub.

2. Horizontal “station” cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and wire map (conductor position on the modular jack). Any defective, split or mis-positioned pairs must be identified and corrected.
3. Testing of the cabling systems rates at TIA category 6 shall be performed to confirm proper functioning and performance.
4. In addition to the above, performance testing shall be performed on all cables. Testing of the transmission performance of station cables (Category 6 and above) shall include the following:
 - a. Length
 - b. Attenuation
 - c. PSNEXT Loss
 - d. Return Loss
 - e. PSELFEXT Loss
 - f. Propagation Delay
 - g. Delay Skew
 - h. Return loss
5. Cables shall be tested to the maximum frequency defined by that standards covering that performance category. Transmission performance testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify “PASS” on each cable and display the specified parameters – comparing test values with standards based “templates” integral to the unit.
6. Testing shall be per ANSI/TIA/EIA 568-B Permanent Link test; Category 6.
7. The maximum length of station cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables. Worst-case performance at 20 degrees C, based on a horizontal cable length of 90 meters and equipment cord length of 4 meters, shall be as follows:

Category 6 (PERMANENT LINK)

Frequency MHz	Attenuation Maximum dB	NEXT Loss Pair to pair (dB)	PS-NEXT Loss (dB; Worst Case)	ELFLEXT Loss pair to pair (dB)	PSEFLEXT Loss (dB)
1.0	2.1	65.0	62.0	63.3	60.3
4.0	4.0	63.0	60.5	51.2	48.2
8.0	5.7	58.2	55.6	45.2	42.2
10.0	6.3	56.6	54.0	43.3	40.3
16.0	8.0	53.2	50.6	39.2	36.2
20.0	9.0	51.6	49.0	37.2	34.2
25.0	10.1	50.0	47.3	35.3	32.3
31.25	11.4	48.4	45.7	33.4	30.4
62.5	16.5	43.4	40.6	27.3	24.3
100.0	21.3	39.9	37.1	23.3	20.3

- D. Propagation Delay
1. The maximum propagation delay determined according to TIA/EIA –568-B for a permanent link configuration shall be less than 518-ns measured at 10MHz. (Note: In determining the channel and permanent link propagation delay, the propagation delay contribution of connecting hardware is assumed to not exceed 2.5 ns from 1MHz to 100MHz.)
- E. Delay Skew
1. The difference in propagation delay between the fastest and slowest pair in a cable shall not exceed the parameters below and the skew between all pair combinations shall not vary more than 610 ns when measured according to TIA/EIA-568-B and ASTM 4566.
 - a. Category 645ns between 1 MHz and 100MHz
- F. Return Loss (permanent Link) Worst Pair
1. Frequency dB
 - a. 1-20 MHz 19
 - b. 20-100 MHz $19-7\text{Log}(f/20)$
 2. In order to establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an 8-position Category 6 Modular Plug (8-pin) to facilitate testing. Nominal velocity of propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP data is available from the cable manufacturer for the exact cable type under test.
 3. In the event results of the tests are not satisfactory, the contractor shall make adjustments, replacement and changes are necessary, and shall then repeat the test or tests which disclosed faulty or defective material, equipment or installation method, and shall make additional tests as the Engineer deems necessary at no additional expense to the project.
- G. Fiber Optic Cable
1. General
 - a. The fibers utilized in the installed cable be traceable to the manufacturer. Upon request by the owner, the contractor shall provide cable manufacturer's test report for each reel of cable provided. These test reports shall include (1) manufacturers on reel attenuation test results at the specified wavelengths for each optical fiber of each reel prior to shipment from the manufacture and (2) on-the-reel Bandwidth performance as tested at the factory.
 2. Tests Prior to Installation
 - a. The contractor at their discretion and at no additional cost to the owner – may perform tests deemed necessary by the contractor to ensure integrity of any owner furnished optical fiber. Tests may range from a simple “flashlight test” to an OTDR of each optical fiber of each cable reel prior to installation. Upon request, the contractor shall supply this test data to the Engineer prior to installation.

3. Tests After Installation
 - a. Upon completion of cable installation and termination, the Fiber Optic cabling shall be tested to include:
 - 1) Optical Attenuation ("Insertion Loss" Method)
4. Optical Attenuation Testing
 - a. Optical Attenuation shall be measured on all terminated optical fibers in both directions of transmission using the "Insertion Loss" method. Measurement shall be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made.
 - b. Multi-mode fibers shall be tested according to the EIA/TIA 526-14A, Method B at 850 ± 30 nm. Single mode fibers (if applicable) shall be tested according to the EIA/TIA 526-7-1998, Method A-1. Testing shall be at 1300 ± 20 nm.
 - c. Attenuation of optical fibers shall not exceed the values calculated at follows:
 - 1) $\text{Attenuation (max.)} = 2 * C + L * F + S \text{ dB}$
 - 2) Where C is the maximum allowable Connector Loss (in dB), L is the length of the run (in kilometers) and F is the maximum allowable fiber loss (in dB/km). S is the total splice loss (# of splices * max. attenuation per splice).

3.05 DOCUMENTATION

- A. General
 1. Upon Completion of the installation, the contractor shall provide three (3) full Documentation Sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.
 2. Documentation of Test Results shall be submitted in hard copy or in electronic form (preferred). Electronic documents may be submitted on CD-ROM. Where documentation provided in electronic form requires unique software (other than a MS-Word™ compatible Word Processor or MS-Excel™ spreadsheet) for viewing test results, the contractor shall provide along with the above documentation, one (1) licensed copy of such software. The software shall run on MICROSOFT WINDOWS-based personal computer supplied by the owner.
 3. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.) This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase.

4. The engineer may request that a 10% random field re-test be conducted on the cable system – at no additional cost – to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the owner.
- B. Test Data – Copper Media
1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s)
 2. Printouts generated for each cable by the wire (or fiber) test instrument (e.g. PentaScanner or Optical Power Meter) shall be submitted as part of the documentation package. Alternately the contractor may furnish this information in electronic form (CD-ROM).
- C. Test Data – Fiber Optic Media
1. Test results shall include a record of test wavelengths, cable type, fiber and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
- D. Cross-Connect Data
1. As noted above, it shall be the responsibility of the contractor to work with the owner to provide the necessary assistance to allow owner and/or Telephone Company personnel to make the necessary connections to establish telephone service on the new cable system. These activities include, but are not limited to:
 - a. A general wiring overview.
 - b. Detailed cross connect documentation (relating SIO I.D. Room Number and Riser pair). The latter shall be in the form of an electronic format database (dBase, MS Excel or convertible format).
- E. As-built Construction Drawings
1. Drawings include with the specification set shall be modified by the contractor to denote as-built information.
 2. The drawings are to include routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.
 3. The owner, through the consultant, will provide floor plans in paper and electronic (“dwg”, AutoCAD current release) formats on which as-built construction information can be added. These documents will be modified accordingly by the contractor to denote as-built information as defined above and returned to the consultant for acceptance. This information shall be supplied to the consultant/engineer no later than four (4) weeks prior to the scheduled occupancy of the building.

4. The contractor shall annotate the base drawings and return to the A/E in hard copy (same plot size as originals) and electronic (AutoCAD current release) form.
5. Each drawing submitted by the contractor as part of the Project Documentation shall be identified as an "As-Built" drawing and include the contractor name and/or logo, and the date of the drawing.
6. All fonts, color, layer, model space/paper space conventions established in the base drawings shall be retained by the contractor in preparation of the As-Built drawings.
7. Prior to generation of the drawings, the contractor shall provide a sample file and test plot to the Engineer for review and approval.
8. All documentation, including hard copy and electronic forms shall become the property of the owner,

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 1. Telecommunications mounting elements.
 2. Backboards.
 3. Telecommunications equipment cabinets.
 4. Grounding.
- B. Related Requirements:
 1. Section 27 05 26 "Grounding and Bonding for Communications Systems"
 2. Section 26 05 33 - "Raceways and Boxes for Electrical Systems"
 3. Section 27 10 00 "Structured Cabling" for voice and data cabling associated with system panels and devices.

1.03 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. LAN: Local area network.
- C. RCDD: Registered Communications Distribution Designer.

1.04 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Qualification Data: For installer, qualified layout technician, installation supervisor, and field inspector.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

PART 2 PRODUCTS

2.01 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 48 inches (19 by 1220 by 2440 mm).

2.02 EQUIPMENT CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden Inc
 - 2. Cooper B-Line.
 - 3. Hubbell Premise Wiring.
 - 4. Leviton Commercial Networks Division.
 - 5. Panduit Corp.
 - 6. Siemon Co. (The).
 - 7. Tyco Electronics Corporation; AMP Products.
- B. General Requirements:
 - 1. Modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
 - 2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch (480-mm) panel mounting and tapped to accept 12-24 screws.

3. Hardware mounting depth (from front of channel upright to wall) shall be 12-inches.
 4. Shall have a load-bearing capacity of 100 lbs or greater.
 5. Constructed of painted steel or aluminum and offer a minimum usable mounting height of 12 RU (RU= 1 ¾ inch) and be a minimum of 12 inches deep. Access to the rear of the rack-mounted equipment shall be by a hinged arrangement.
 6. Finish: Manufacturer's standard, baked-polyester powder coat.
- C. Modular Wall-Mounted Cabinets:
1. Be of a “two section” construction including (1) wall-mount section, and (2) drilled and tapped rail sections. Each section shall be hinged to facilitate access. Hinges shall be configurable to open LEFT OR RIGHT.
 2. Screened ventilation openings.
 3. Cable access provisions.
 4. Grounding bus bar.
 5. Rack-mounted, 550-cfm fan with filter.
 6. Power strip.
 7. Baked-polyester powder coat finish.
 8. All cabinets keyed alike.
- D. Cable Management:
1. Metal, with integral wire retaining fingers.
 2. Baked-polyester powder coat finish.
 3. Vertical cable management panels with covers.
 4. Provide horizontal crossover cable manager

2.03 POWER STRIPS

- A. Power Strips: Comply with UL 1363.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Rack mounting.
 3. Six, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R receptacles.
 4. LED indicator lights for power and protection status.
 5. LED indicator lights for reverse polarity and open outlet ground.
 6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
 7. Cord connected with 15-foot (4.5-m) line cord.
 8. Rocker-type on-off switch, illuminated when in on position.
 9. Peak Single-Impulse Surge Current Rating: 13 kA per phase.
 10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

2.04 GROUNDING

- A. Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
 - 1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
 - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with J-STD-607-A.

2.05 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 EXECUTION

3.01 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

3.02 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.03 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.04 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.05 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.06 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

- B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A.
- D. Labels shall be preprinted or computer-printed type.

SECTION 27 51 16 - PUBLIC ADDRESS SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Telephone Paging Interface.
 - 2. Sound Receiver / Amplifier.
 - 3. CD Player.
 - 4. Equipment cabinet.
 - 5. Loudspeakers.
 - 6. Conductors and cables.
 - 7. Raceways.

1.03 DEFINITIONS

- A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.
- B. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For equipment cabinets and components. 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. Control panels.
3. Calculations: For sizing backup battery.
4. 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.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data: For qualified Installer.
- C. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For public address and mass notification systems to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 1. Personnel certified by NICET as Audio Systems Level III Technician.
- B. Source Limitations: Obtain public address system from single source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.08 COORDINATION

- A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Atlas Sound LP.
 2. VALCOM.
 3. Viking.

2.02 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. System Functions:
1. Selectively connect any zone to any available signal channel.
 2. Selectively control sound from designated inputs.
 3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
 4. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
 5. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 6. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.03 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch housing complying with TIA/EIA-310-D.

2.04 TELEPHONE PAGING INTERFACE

- A. Bogen Model #TAMB.
- B. Equal model by Valcom, or Viking.

- C. Adaptor shall accept voice signal from any telephone extension dialing access and automatically connect to amplifier input and provide program override for preselected paging zones.

2.05 SOUND RECEIVER / AMPLIFIER

- A. Bogen Model #RM350D.
- B. Equal model by Denon Electronics, Atlas Sound, or Niles Audio Corporation.

2.06 CD PLAYER

- A. Bogen Model #DCM-290P.
- B. Equal model by Denon Electronics, or Sony.
- C. 5-disc auto-changer.
- D. Ability to play MP3 cds.

2.07 EQUIPMENT CABINET

- A. Comply with TIA/EIA-310-D.
- B. House amplifiers and auxiliary equipment.
- C. Cabinet Housing:
 - 1. Constructed of 0.0478-inch steel, minimum, with front- and rear-locking doors and standard TIA/EIA-310-D-compliant, 19-inch racks.
 - 2. Arranged for wall mounting.
 - 3. Sized to house all equipment indicated, plus spare capacity.
 - 4. Include 20 percent minimum spare capacity for future equipment.
- D. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.
- E. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.

2.08 LOUDSPEAKERS

- A. Cone-Type Loudspeakers:
 - 1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
 - 2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 - 3. Size: 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.

4. Minimum Dispersion Angle: 100 degrees.
5. Rated Output Level: 10 W.
6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
7. Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.

2.09 CONDUCTORS AND CABLES

- A. Jacketed, twisted pair and twisted multipair, untinned solid copper.
 1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch thick.

2.10 RACEWAYS

- A. Conduit and Boxes: Comply with Section 26 05 33 "Raceway and Boxes for Electrical Systems."
 1. Outlet boxes shall be not less than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

PART 3 EXECUTION

3.01 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 1. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.02 INSTALLATION OF RACEWAYS

- A. Comply with requirements in Section 26 05 33 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.03 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Cable Installation Requirements:
 - 1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 - 2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - 3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 - 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
- C. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches above ceiling by cable supports not more than 60 inches apart.
 - 3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
- D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.04 INSTALLATION

- A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

- C. Equipment Cabinets:
 - 1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically.
 - 2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 - 3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
- D. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.05 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes as specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing public address system and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Perform tests that include originating program and page messages, amplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
 - 4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio.
 - b. Repeat test for each separately controlled zone of loudspeakers.
 - c. Minimum acceptance ratio is 50 dB.

5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
 6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. Maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
 7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
 8. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
- D. Public address system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

3.07 STARTUP SERVICE

- A. Perform startup service.
1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 2. Complete installation and startup checks according to manufacturer's written instructions.

3.08 ADJUSTING

- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
- B. 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.

3.09 DEMONSTRATION

- A. Train owner's maintenance personnel to adjust, operate, and maintain the public address system and equipment.

SECTION 28 23 00 - VIDEO SURVEILLANCE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. General Description: Work includes the installation of new IP cameras and a new NVR with specified storage capacity. The project includes both interior and exterior cameras

1.03 DEFINITIONS

- A. AGC: Automatic gain control.
- B. BNC: Bayonet Neill-Concelman - type of connector.
- C. B/W: Black and white.
- D. CCD: Charge-coupled device.
- E. FTP: File transfer protocol.
- F. IP: Internet protocol.
- G. LAN: Local area network.
- H. MPEG: Moving picture experts group.
- I. NTSC: National Television System Committee.
- J. PC: Personal computer.
- K. PTZ: Pan-tilt-zoom.
- L. RAID: Redundant array of independent disks.
- M. TCP: Transmission control protocol - connects hosts on the Internet.

N. UPS: Uninterruptible power supply.

O. WAN: Wide area network.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
 - 3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
 - 4. UPS: Sizing calculations.
 - 5. Wiring Diagrams: For power, signal, and control wiring.
- C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For cameras, power supplies, monitors, , digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - 1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NECA 1.

- C. Comply with NFPA 70.
- D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

1.08 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.
 - 2. Interior, Controlled Environment: System components, except central-station control unit, installed in 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.
 - 3. Exterior Environment: 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. Use NEMA 250, Type 4 enclosures.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty: The new components shall be warranted for 3 years from date system is operational. NVR service shall be one day turn around for any system repair required during the warranty period

PART 2 PRODUCTS

2.01 SYSTEM REQUIREMENTS

- A. Proposed work as described below, and in schedule on the plans.
- B. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.
- 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.
- E. Cable: Cat 6 cable shall be provided and routed from each camera location to the data closet. Cables shall be supported according to NEC. Cable sheath color selection shall blend with route surround color (grey).
- F. DVR: Provide new DVR with sufficient hard drive memory to store 120 days of system records. Configure brackets to support unit in data rack cabinet. Include ExacqVision Enterprise software subscription for one year. Minimum performance requirements:
 - 1. 33 TB Storage Capacity in Raid 5 Configuration.
 - 2. ExacqVision Enterprise Upgrade.
- G. PoE Switches: Specification provided under separate cover.
- H. Software, contractor shall provide ExacqVision software licenses for each new camera. Each camera shall be password protected according to Library convention.

2.02 INDOOR IP CAMERAS

- A. Manufacturers: The typical indoor camera for wide angle general views to be provided by the following:
 - 1. AXIS Communications Model M3006-V.
 - 2. Samsung Model SND-6084.
 - 3. Pelco

2.03 EXTERIOR IP CAMERAS

- A. Manufacturers: Exterior cameras to be provided by the following:
 - 1. AXIS Communications Model 3367-VE.
 - 2. Pelco.

2.04 CAMERA-SUPPORTING EQUIPMENT

- A. Manufacturers: Provide products by the following:
 - 1. AXIS Communications.
 - 2. Samsung.
 - 3. Pelco.
- B. Each camera shall be equipped with the appropriate mounting bracket based on the building or pole material at each location.
- C. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

- D. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.
- E. Protective Housings for Fixed Cameras: 6061 T6 aluminum enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.
 - 1. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display.
 - 2. Camera Viewing Window: Polycarbonate window, aligned with camera lens.
 - 3. Duplex Receptacle: Internally mounted.
 - 4. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
 - 5. Built-in, thermostat-activated heater units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.
 - 6. Sun shield shall not interfere with normal airflow around the housing.
 - 7. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
 - 8. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.
 - 9. Enclosure Rating: NEMA Type 4.

2.05 MONITORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Bosch Security Systems, Inc.
- B. Color:
 - 1. Metal cabinet units designed for continuous operation.
 - 2. Screen Size (Diagonal Dimension): 17".
 - 3. Horizontal Resolution: 300 lines.
 - 4. Minimum Front Panel Devices and Controls: Power switch; power-on indicator; and brightness, contrast, color, and tint controls.
 - 5. Degaussing: Automatic.
 - 6. Mounting: Single, 14-inch, vertical, EIA 19-inch electronic equipment rack or cabinet complying with CEA 310-E.
 - 7. Electrical: 120-V ac, 60 Hz.

2.06 DIGITAL VIDEO RECORDER

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AXIS Communications.
 - 2. Bosch Security Systems, Inc.
 - 3. Pelco.
 - 4. Samsung.
- B. Description: Digital, time-lapse type, full-frame and motion recorder, with removable hard drive.
 - 1. Recording Time: 400 hours minimum.
 - 2. Resolution: 720 by 480 lines, minimum.
 - 3. Programming shall be from trackball and push buttons on face of the recorder, settings shall be displayed on any video monitor connected to the recorder. Programming shall include the following:
 - a. Motion analysis graph.
 - b. Password protection.
 - c. Alarm and timer controls.
 - d. Continuous recording option.
 - e. Time-lapse operating modes.
 - f. Search video by time, event, or motion.
 - 4. Programming: SmartMedia card for software updating, image archiving, and image transfer to a PC.
 - 5. Storage: 80-GB, removable hard drive. Software shall permit hot-swapping drives.
 - 6. Compression: MPEG-2.
 - 7. Time and Date Generator: Records time (hr:min:sec) and date legend of each frame.
 - 8. Audio Recording: 70 to 7000 Hz. Phono and microphone input; phono output.
 - 9. Mounting: Standard 19-inch rack complying with CEA 310-E, or freestanding desktop.

PART 3 EXECUTION

3.01 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, WAN, and IP network before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

- D. Operation: contractor shall complete all terminations, camera configuration, NVR configuration, camera view adjustments and recording formats to make the installation fully functional.

3.02 WIRING

- A. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- B. Wiring Method: Install cables in raceways unless otherwise indicated.
 - 1. Except raceways are not required in accessible indoor ceiling spaces and attics.
 - 2. Except raceways are not required in hollow gypsum board partitions.
 - 3. Conceal raceways and wiring except in unfinished spaces.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- D. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- E. For LAN connection and fiber-optic and copper communication wiring, comply with Section 27 10 00 "Structured Cabling."
- F. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.03 VIDEO SURVEILLANCE SYSTEM 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. Install power supplies and other auxiliary components at control stations unless otherwise indicated.
- 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. Avoid ground loops by making ground connections only at the control station.
- F. Identify system components, wiring, cabling, and terminals according to Section 26 05 53 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. 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. Prepare video-surveillance equipment for acceptance and operational testing as follows:
 - a. Prepare equipment list described in "Informational 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.
 - g. Connect and verify responses to alarms.
 - h. 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.
- D. Video surveillance system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.05 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.

3.06 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.

3.07 OWNER SYSTEM ORIENTATION

- A. Contractor shall provide camera and NVR owner and maintenance manuals. Documents shall be provided in hard and soft copy.
- B. Contractor shall provide a record drawing showing the system as installed.
- C. A training session shall be conducted. The training session shall be videotaped for future use by the owner.

75. Play Equipment Rest Area 31, Item SPV.0105.06.

A Description

Furnish and install play equipment, complete and in place, at the locations as designated on the plans or as directed by the engineer.

B Materials

Furnish one of the following:

- Play equipment by Playworld, Simple Play Model PSD-1107-FTD, natural color; or
- Play equipment by Miracle, Tot's Choice, Model 718-5034, earth tone color; or
- Play equipment by Gametime, Curve-Around Model 19548, natural color; or
- Play equipment by Cyber Catalog Structure, Voltage Model 2239, natural color; or
- Equal.

C Construction

Install play equipment as indicated on the plans, according to manufacturer's specifications or as directed by the engineer.

D Measurement

The department will measure Play Equipment Rest Area (No.) as a single complete lump sum unit of work for the installation, acceptably completed in place.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.06	Play Equipment Rest Area 31	LS

Payment is full compensation for furnishing and installing all materials; furnishing and installing fixture and lamps; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

76. Play Lot Surfacing Rest Area 31, Item SPV.0105.07.**A Description**

Furnish and install Play Lot Surfacing at the locations shown on the plans and according to the requirements of standard spec 602 and 645, the plans, and as hereinafter provided.

B Materials

Furnish the following:

- Geotextile Fabric, Type SAS
- Brown poured-in place play lot rubber surface material
- Granular backfill shall be provided per standard specifications standard spec 209

Manufacturer information for play lot rubber surface, or approved equal:

Sofsurfaces Inc.

4393 Discovery Line, P.O. Box 239, Petrolia, ON Canada

Toll Free: (800) 263-2363

International: (519) 882-8799

Fax: (519) 882-2697

PlayCore

401 Chestnut Street, Suite 310, Chattanooga, TN 37402

Phone: (423) 265-PLAY (7529)

Fax: (423) 425-3124

Email: info@playcore.com

DuraPlay Safety Surfaces

1818 Flite Acres Road

Wimberley, TX 78676

(512)847-2473

Fax: (512)847-9577

C Construction

Install play lot surfacing as indicated on the plans, according to: the standard specifications, manufacturer's specifications, or as directed by the engineer.

D Measurement

The department will measure Play Lot Surfacing Rest Area (No.) as a single complete lump sum unit of work, for completing acceptable work.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.07	Play Lot Surfacing Rest Area 31	LS

Payment is full compensation for furnishing all materials for the play lot surface including geotextile fabric, rubber surface material, and granular backfill; installing the surface; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

77. Well System Controls Rest Area 31, Item SPV.0105.08.

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 Room 108 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 50 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 Room 112 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 floppy disks.

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 Rest Area (No.) as a single lump sum unit of work, 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.0105.08	Well System Controls Rest Area 31	LS

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

78. Construction Staking Joint Layout, Item SPV.0105.09.

A Description

This work shall consist of staking the location of all joints on the project, including mainline and intersections to accommodate the concrete paving operation. The contractor shall set all points necessary to establish the horizontal position of the dowel bar sets and saw joints in the concrete pavement according to the plans or as directed by the engineer.

B (Vacant)

C Construction

Plan and locate all points necessary to establish the horizontal position of the transverse and longitudinal joints in the concrete to prevent uncontrolled cracking. Mark the location of all concrete joints in the field. Make joint adjustments as required to fit field conditions, traffic staging, or as directed by the engineer.

The concrete pavement maximum joint spacing is 15 feet as shown in the Standard Detail Drawings unless otherwise approved by the engineer.

D Measurement

The department will measure Construction Staking Concrete Pavement Joint layout as a single lump sum unit of work, 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.0105.09	Construction Staking Joint Layout	LS

Payment is full compensation for survey work necessary to locate all dowel bar sets and saw joints on the mainline and intersections, for adjustments to match field conditions and traffic staging.

79. Temporary Shoring, Item SPV.0165.01.

A Description

This work shall consist of designing and providing temporary shoring at locations described in the plans.

B Materials

B.1 Shoring Design

Provide a shoring design for each location where the plan requires temporary shoring. Have a professional engineer, registered in the State of Wisconsin and knowledgeable of the specific site conditions and requirements verify the adequacy of the design. Submit one copy of each shoring design, signed and sealed by the same professional engineer verifying the design, to the engineer for incorporation into the permanent project record.

C Construction

Provide temporary shoring at each required location conforming to the design developed for that location.

Remove the shoring when it is no longer needed unless the engineer allows it to remain in place. Backfill the space that is excavated but not occupied by the new permanent construction conforming to standard spec 206.3.13.

D Measurement

The department will measure Temporary Shoring by the square foot acceptably completed at locations described in the plans, measured as the area of exposed face in the plane of the shoring from the ground line in front of the shoring to a maximum of one foot above the retained grade. Shoring used for staged construction in multiple configurations without removal and reinstallation will be measured once based on the configuration with the largest area of exposed face.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.01	Temporary Shoring	SF

Payment is full compensation for designing and providing shoring; for providing a signed and sealed copy of the design; and for backfilling and removing the shoring.

The department will not pay for temporary shoring, installed for contractor convenience that is not required in the plans.

80. Construction Staking, Sidewalk, Item SPV.0165.02.**A Description**

Perform all construction staking required to establish the horizontal and vertical position of sidewalk placement.

B (Vacant)**C Construction**

Use construction staking methods that comply with standard spec 650.3 or as approved by the engineer.

D Measurement

The department will measure Construction Staking, Sidewalk, by the square foot, 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.0165.02	Construction Staking, Sidewalk	SF

Payment is full compensation for locating and setting all construction stakes; for relocating and resetting damaged or missing construction stakes; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

81. Gravity Wall Modular Block Landscape, Item SPV.0165.03.

A Description

This special provision describes designing, furnishing materials and erecting a permanent earth retention system according to the lines, dimension, elevations and details as shown on the plans and provided in the contract. The design life of the wall and all wall components shall be 75 years minimum.

B Materials

B.1 Proprietary Wall Systems

The supplied wall system must be from the department's approved list of Modular Block Gravity Landscape Wall systems (Modular Block Gravity Landscape Walls). Proprietary wall systems must conform to the requirements of this specification and be pre-approved for use by the department's Bureau of Structures. The name of the pre-approved proprietary wall system selected shall be furnished to the engineer within 25 days after the award of contract. The location of the plant manufacturing the facing units shall be furnished to the engineer at least 14 days prior to the project delivery.

The department maintains a list of pre-approved Modular Block Gravity Landscape Wall systems. To be eligible for use on this project, a system must have been pre-approved by the Bureau of Structures and added to that list prior to the bid opening date. To receive pre-approval, the retaining wall system must comply with all pertinent requirements of this provision and be prepared according to the requirements of Chapter 14 of the department's LRFD Bridge Manual. Information and assistance with the pre-approval process can be obtained by contacting the Bureau of Structures, Structures Maintenance Section in Room 601 of the Hill Farms State Transportation Building in Madison or by calling (608) 266-8494.

B.2 Design Requirements

It is the responsibility of the contractor to submit a design and supporting documentation as required by this special provision, for review and acceptance by the department, to show the proposed wall design is in compliance with the design specifications. The submittal shall include the following items for review: detailed plans and shop drawings, complete design calculations, explanatory notes, supporting materials, and specifications. The detailed plans and shop drawings shall include all details, dimensions, quantities and cross-sections necessary to construct the walls. Submit electronically to the engineer and Structures Maintenance Section for review and acceptance. Submit no later than 60 days from the date

of notification to proceed with the project and a minimum of 30 days prior to the date proposed to begin wall construction.

The plans and shop drawings shall be prepared on reproducible sheets 11 inch x 17 inch, including borders. Each sheet shall have a title block in the lower right corner. The title block shall include the project identification number and structure number. Design calculations and notes shall be on 8 ½ inch x 11 inch sheets, and shall contain the project identification number, name or designation of the wall, date of preparation, initials of designer and checker, and page number at the top of the page. All plans, shop drawings, and calculations shall be signed, sealed and dated by a professional engineer licensed in the State of Wisconsin.

The design of the Modular Block Gravity Landscape Wall shall be in compliance with the AASHTO LRFD Bridge Design Specifications 6th Edition 2012, (AASHTO LRFD) with latest interim specifications for Mechanically Stabilized Earth Walls, WisDOT's current Standard Specifications for Highway and Structure Construction (standard spec), Chapter 14 of the WisDOT LRFD Bridge Manual and standard engineering design procedures as determined by the department. Loads, load combinations, load and resistance factors shall be as specified in AASHTO LRFD Section 11. The associated resistance factors shall be defined according to Table 11.5.7-1 LRFD.

Design and construct the walls according to the lines, grades, heights and dimensions shown on the plans, as herein specified, and as directed by the engineer.

Walls shall be designed for a minimum live load surcharge of 100 psf according to Chapter 14 of the WisDOT LRFD Bridge Manual or as shown on the plans.

A maximum value of the angle of internal friction of the wall backfill material used for design shall be assumed to be 30 degrees without a certified report of tests. If a certified report of tests yields an angle of internal friction greater than 30 degrees, the larger test value may be used for design, up to a maximum value of 36 degrees.

An external stability check at critical wall stations showing Capacity Demand Ratio (CDR) for sliding, eccentricity, and bearing checks is provided by the department and are provided on the wall plans.

The design of the Modular Block Gravity Landscape Wall by the contractor shall consider the internal and compound stability of the wall mass according to AASHTO LRFD 11.10.6. Internal stability shall also be considered at each block level. Calculations for factored stresses and resistances shall be based upon assumed conditions at the end of the design life. The width of the modular block from front face to back face of the wall shall be included in the design computations and shown on the wall shop drawings. Compound stability shall be computed for the applicable strength limits. Sample analyses and hand calculations shall be submitted to verify the output of any software program used. The design calculations and notes shall clearly indicate the Capacity to Demand Ratios (CDR) for all internal and external stabilities as defined in AASHTO LRFD.

Facing units shall be designed according to AASHTO LRFD 11.10.2.3.

The minimum embedment of the wall shall be 1 foot 6 inches, or as given on the contract plan. Step the leveling pad to follow the general slope of the ground line. Frost depth shall not be considered in designing the wall for depth of leveling pad. Additional embedment may be detailed by the contractor, but will not be measured for payment.

The leveling pad shall be as wide as the proposed blocks plus 6-inches, with 6-inches of the leveling pad extending beyond the front face of the blocks.

Wall facing units shall be installed on a concrete leveling pad or base aggregate leveling pad. The bottom row of blocks shall be horizontal and 100% of the block surface shall bear on the leveling pad.

The concrete leveling pad shall be as wide as the proposed blocks plus six inches, with six inches of the leveling pad extending beyond the front face of the blocks. The minimum thickness of the leveling pad shall be 6-inches. A concrete leveling pad is required for the following scenarios:

- a. When the wall height measured from the top of the leveling pad to the top of the wall exceeds 5 feet at any point along the entire wall length
- b. A structure number has been assigned (such as R-XX-XXX), regardless of wall height

A base aggregate leveling pad shall be used when a concrete leveling pad is not required. The base aggregate leveling pad shall be as wide as the blocks plus 12 inches, and the modular blocks shall be centered on the leveling pad. The minimum thickness of the leveling pad shall be 12-inches after compaction. The leveling pad shall be made from base aggregate dense 1¼-inch in conformance with standard spec 305.

B.3 Wall System Components

Materials furnished for wall system components under this contract shall conform to the requirements of this specification. All certifications related to material and components of the wall systems specified in this subsection shall be submitted to the engineer.

B.3.1 Wall Facing

Wall facing units shall consist of precast modular concrete blocks. All units shall incorporate a mechanism or devices that develop a mechanical connection between vertical block layers. Units that are cracked, chipped, or have other imperfections according to ASTM C1372, or have excessive efflorescence shall not be used within the wall. A single block type and style shall be used throughout each wall. The color and surface texture of the block shall be as given on the plan or chosen by the engineer.

The top course of facing units shall be a solid precast concrete unit designed to be compatible with the remainder of the wall unless a cast-in-place concrete cap is shown on the plans. The finishing course shall be bonded to the underlying facing units with a durable, high strength, flexible adhesive compound compatible with the block material. A formed cast-in-place concrete cap may also be used to finish the wall. A cap of this type shall be designed to have texture, color, and appearance that complement the remainder of the wall. The vertical dimension of the cap shall not be less than 3½ inches. Expansion joints shall be placed in the cap to correspond with each 24 inch change in vertical wall height and at maximum spacing of 10 feet.

Block dimensions may vary no more than ±1/8 inch from the standard values published by the manufacturer according to ASTM C1372. Blocks must have a minimum depth (front face to back face) of 8 inches. The minimum front face thickness of blocks shall be 4 inches measured perpendicular from the front face to inside voids greater than 4 square inches. The minimum allowed thickness of any other portions of the block is 1¾ inches. The front face of the blocks shall conform to plan requirements for color, texture, or patterns.

Cementitious materials and aggregates for modular blocks shall conform to the requirements of ASTM C1372 Section 4.1 and 4.2. Modular blocks shall meet the following requirements.

Test	Method	Requirement
Compressive Strength (psi)	ASTM C140	5000 min.
Water Absorption (%)	ASTM C140	6 max.
Freeze-Thaw Loss (%) 40 cycles, 5 of 5 samples 50 cycles, 4 of 5 samples	ASTM C1262 ^[1]	1.0 max. ^[2] 1.5 max. ^[2]

[1] Test shall be run using a 3% saline solution.

[2] Test results that meet either of the listed requirements for Freeze-Thaw Loss are acceptable.

All blocks shall be certified as to strength, absorption, and freeze-thaw requirements unless, due to contract changes after letting, certified blocks are not available when required. At the time of delivery of certified blocks, furnish the engineer a certified test report from a department-approved independent testing laboratory for each lot of modular blocks. The certified test report shall clearly identify the firm conducting the sampling and testing, the type of block, the date sampled, the name of the person who conducted the sampling, the represented lot, the number of blocks in the lot, and the specific test results for each of the stated requirements of this specification. The tests should have been conducted not more than 18 months prior to delivery. A lot shall not exceed 5000 blocks or fraction thereof produced in day. The certified test results will represent all blocks within the lot. Each pallet of blocks delivered shall bear lot identification information. Block lots that do not meet the requirements of this specification or blocks without supporting certified test reports will be rejected and shall be removed from the project at no expense to the department.

A department-approved independent testing laboratory shall control and conduct all modular block sampling and testing for certification. Prior to sampling, the manufacturer's representative shall identify all pallets of modular blocks contained in each lot. All pallets of blocks within the lot shall be numbered and marked to facilitate random sample selection. The representative of the independent testing laboratory shall identify five pallets of blocks by random numbers and shall then select one block from each of these pallets. Solid blocks used as a finishing or top course shall not be selected. The selected blocks shall remain under the control of the person who conducted the sampling until shipped or delivered to the testing laboratory. All pallets of blocks within a lot shall be strapped or wrapped to secure the contents and tagged or marked for identification. The engineer will reject any pallet of blocks delivered to the project without intact security measures. At no expense to the department, the contractor shall remove all rejected blocks from the project.

The department may conduct testing of certified or non-certified modular blocks lots delivered to the project. The department will not conduct freeze-thaw testing on blocks less than 45 days old. If a random sample of five blocks of any lot tested by the department fails to meet any of the requirements of this specification (nonconforming), the contractor shall remove from the project site all blocks from the failed lot not installed in the finished work at no cost to the department, unless the engineer allows otherwise. Nonconforming blocks installed in the finished work will be considered approved by the department as stated in standard spec 106.5(2) and any adjustment to the contract price will not exceed the price of the blocks charged by the supplier.

Wall facing units may consist of precast modular concrete blocks produced by a wet cast process. The concrete blocks shall have a minimum strength of 4000 psi at 28 days. The concrete for the blocks shall be air entrained, with an air content of 6% +/- 1.5%. All materials for the concrete mixture for the blocks shall meet the requirements of standard spec 501. Wall facing units produced by a wet cast process need not be certified as to absorption and freeze-thaw requirements.

B.3.2 Backfill

Furnish and place backfill for Modular Block Gravity Landscape Walls as shown on the plans and as hereinafter provided.

Wall Backfill, Type A, shall comply with the requirements for Coarse Aggregate No. 1 as given in standard spec 501.2.5.4.4. All backfill placed within a zone from the top of the leveling pad to the top of the final layer of wall facing units and within 1 foot behind the back face of the wall shall be Wall Backfill, Type A. This includes all material used to fill openings in the wall facing units.

Backfill placed between retained soil and Type A backfill shall comply with the requirements for Grade 1 Granular Backfill as contained in standard spec 209.2.2. Wall Backfill, Type A, may be used as retained backfill.

B.3.3 Miscellaneous

If plans show sections of cast in place concrete cap or coping, use poured concrete Grade A, A-FA, A-S, A-T, A-IS, A-IP or A-IT concrete conforming to standard spec 501 as modified in standard spec 716. Provide QMP for cast in place cap and coping concrete as specified in standard spec 716, Class II Concrete.

Use a wall leveling pad that consists of poured concrete, Grade A, A-FA, A-S, A-T, A-IS, A-IP, or A-IT concrete conforming to standard spec 501 as modified in standard spec 716. Provide QMP for leveling pad concrete as specified in standard spec 716, Class III Concrete.

If pins are used to align modular block facing units, they shall consist of a non-degrading polymer, or hot dipping galvanized steel and be made for the express use with the modular block units supplied, to develop mechanical interlock between facing unit block layers. Connecting pins shall be capable of holding the wall in the proper position during backfilling. Furnish documentation that establishes and substantiates the design life of such devices.

C Construction

C.1 Excavation and Backfill

Excavation and preparation of the foundation for the Modular Block Gravity Landscape wall and the leveling pad shall be according to standard spec 206. At the end of each working day, provide good temporary drainage such that the backfill shall not become contaminated with run-off soil or water if it should rain. Do not stockpile or store materials or large equipment within 10 feet of the back of the wall.

Place backfill materials in the areas as indicated on the plans and as detailed in this specification. Backfill lifts shall be no more than 8-inches in depth. Backfilling shall closely follow erection of each course of wall facing units.

Conduct backfilling operations in such a manner as to prevent damage or misalignment of the wall facing units or other wall components. At no expense to the department, correct any such damage or misalignment as directed by the engineer. A field representative of the wall supplier shall be available during wall construction to provide technical assistance to the contractor and the engineer.

Do not operate tracked or wheeled equipment on the backfill within 3 feet from the back face of modular blocks. The engineer may order the removal of any large or heavy equipment that may cause damage or misalignment of the wall facing units.

C.2 Compaction

Compact wall backfill Type A with at least three passes of lightweight manually operated compaction equipment acceptable to the engineer.

Ensure adequate moisture is present in the backfill during placement and compaction to prevent segregation and to help achieve compaction.

Compaction of backfill within 3 feet of the back face of the wall should be accomplished using lightweight compaction devices. Use of heavy compaction equipment or vehicles should be avoided within 3 feet of the modular blocks.

C.3 Wall Components

Erect wall facing units and other associated elements according to the wall manufacturer's construction guide and to the lines, elevations, batter, and tolerances as shown on the plans. Center the initial layer of facing units on the leveling pad; then level them and properly align them. Fill formed voids or openings in the facing units with wall backfill, Type A. Remove all debris on the top of each layer of facing units, before placing the next layer of facing units.

Install all pins, rods, clips, or other devices used to develop mechanical interlock between facing unit layers according to the manufacturer's directions.

C.4 Geotechnical Information

Geotechnical data to be used in the design of the wall is given on the wall plan.

D Measurement

The department will measure Wall Modular Block Gravity Landscape LRFD by the square foot, acceptably completed, measured as the vertical area within the pay limits the contract plans show. No other measurement of quantities shall be made in the field. Unless the Engineer directs in writing, a change to the limits indicated on the contract plan, wall area constructed above or below these limits will not be measured for payment.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.03	Wall Modular Block Gravity Landscape	SF

Payment is full compensation for supplying a design and shop drawings; preparing the site, including all necessary excavation and disposal of materials; supplying all necessary wall components to produce a functional wall system including cap, copings and leveling pad; constructing the retaining system including drainage system; providing backfill, backfilling, compacting, developing/completing/documenting the quality management program, performing compaction testing; and for furnishing all tools, labor, equipment, and incidentals necessary to complete the contract work.

Parapets, railings, and other items above the wall cap or coping will be paid for separately. Vehicle barrier and its support will be paid separately.

Any required topsoil, fertilizer, seeding or sodding and mulch will be paid for at the contract unit price of topsoil, fertilizer, seeding or sodding and mulch, respectively.
(20150824)

82. Soil Nail Reinforced Slope, Item SPV.0165.04.

A Description

This work consists of constructing a permanent soil nail reinforced slope as specified herein and as shown on the Contract Plans. The contractor shall furnish all labor, materials, and equipment required to complete the work. The contractor shall design the soil nail reinforced slope to meet the performance requirements specified herein or shown on the Contract Plan.

B Materials

B.1 Definitions

The following definitions shall apply to this special provision:

- A. Contractor: The specialty firm who is responsible for performing the soil nail design and construction.
- B. Design Drawings: Drawings prepared by the contractor's design engineer and submitted by the contractor to include the detailed soil nail design.
- C. Design Engineer: The professional engineer employed or hired by the contractor who designs the soil nail structure. This person must meet the experience requirements in Section 1.5.
- D. Engineer: The owner's engineer, project manager, or other representative.
- E. Inspector: The owner's field representative on the project site.
- F. Owner: The Agency responsible for the project.
- G. Contract Plans: Drawings developed by the engineer and provided by the owner for bidding purposes.
- H. Project Manager: An employee of the contractor supervising the work and who has a minimum of three years of experience with soil nail projects of similar size and scope.

B.2 References

Codes and Standards:

- Standard Specifications for the Construction of Roads and Bridges on Federal Highway Projects, FP-14 (FHWA, 2014)
- AASHTO Standard Specification for Highway Bridges, current Edition, including current interim specifications
- Geotechnical Engineering Circular No. 7, Soil Nail Walls - Reference Manual

B.2 Available Information

- Project No. 1070-00-71, prepared by Short Elliott Hendrickson, dated November 2, 2015. The Contract Plans include the preliminary design developed for the project, as well as plan view, profile, and typical cross sections for the proposed reinforced slope.
- A "Geotechnical Exploration and Analysis Report" prepared by Soils & Engineering Services, Inc. dated October 26, 2015 containing soil borings in the vicinity of the soil nail reinforced slope is available for the contractors use to design the soil nails reinforced slope.

B.3 Project Site Survey

Before bidding the work, the contractor shall review the available subsurface information and visit the project site to assess the site geometry, equipment access conditions, and locations of existing structures and above-ground facilities. The contractor, at their own expense, may perform an additional subsurface investigation to aid in preparation of their bid. Requests for access to the site for performing subsurface investigations must be made in writing to the Wisconsin Department of Transportation.

The contractor is responsible for field locating and verifying the locations of all utilities shown on the Contract Plans prior to starting the work. The contractor shall notify the engineer of any utility locations different from those shown on the Contract Plans that may require relocation of foundation elements or modification to the structure design. Subject to the engineer's approval, additional cost to the contractor due to relocation and/or design modifications resulting from incorrect utility locations on the Contract Plans will be paid as Extra Work.

The contractor shall be responsible for providing the necessary survey and alignment control during the excavation, locating drill holes, and verifying limits of the soil nail reinforced slope installation. Verify the limits of the structures and ground survey data before preparing the detailed drawings.

B.4 Contractor Experience

The soil nailing contractor shall meet the following experience requirements:

- Have completed at least three permanent soil nail projects during the past three years totaling at least 10,000 ft² of soil nail face area and at least 500 permanent soil nails.
- Provide a registered professional engineer with experience in the design of permanent soil nails for at least three completed projects over the past three years.
- Provide on-site supervisors and drill operators with experience installing permanent soil nails on at least three projects over the past three years.
- Submit a brief description of at least three projects, including the owner agency's name, address, and current phone number; location of project; project contract value; and scheduled completion date for the project.

B.5 Submittals

B.5.1 Personnel

At least 45 calendar days before starting soil nail work, submit names of the engineer, on-site supervisors, and drill operators assigned to the project, and a summary of each individual's experience. Only those individuals designated as meeting the experience requirements shall be used for the project. The contractor cannot substitute for any of these individuals without written approval of the owner or the owner's engineer. The owner's engineer shall approve or reject the contractor qualifications and staff within seven calendar days of receipt of the submission. Work shall not be started nor materials ordered until the contractor's qualifications have been approved by the owner's engineer. The owner's engineer may suspend the work if the contractor substitutes unapproved personnel for approved personnel during construction. If work is suspended due to the substitution of unqualified personnel, the contractor shall be fully liable for all additional costs resulting from the suspension of work, and no adjustment in contract time resulting from the

suspension of the work shall be allowed. The contractor shall have overall contractual responsibility for both the design and construction.

B.5.2 Design Submittals

B.5.2.a General

- At least 30 calendar days before the planned start of the reinforced slope construction, the contractor shall submit complete design calculations and Design Drawings to the Engineer for review and approval. Include all details, dimensions, quantities, ground profiles, and cross-sections necessary to conduct the work.
- Design drawings and calculations shall be signed and sealed by the contractor's design engineer, previously approved by the owner's engineer.
- Submit sets of the design drawings with the initial submission. The design drawings shall be prepared to the (owner) standards. The owner's engineer will approve or reject the contractor's submittal within 15 calendar days of the receipt of the complete submission.
- The owner's engineer will approve or reject the contractor's submittals within 14 calendar days of the receipt of the complete submission.
- One set will be returned with any indicated corrections. If revisions are necessary, make the necessary changes and resubmit revised sets. When the drawings are approved, furnish 4 sets of the approved drawings.
- The contractor shall not begin the work until the submittal requirements are satisfied and found acceptable by the Engineer.
- Changes or deviations from the approved submittals must be re-submitted for approval. No adjustments in contract time or delay, or impact claims will be allowed due to incomplete submittals.

B.5.2.b Design Calculations

Design calculations shall include, but not be limited to, the following items.

- A narrative describing the overall soil nail reinforced slope design.
- Applicable code requirements and references.
- Design criteria, including soil/rock shear strength parameters (friction angle and cohesion), unit weights, pullout resistances, steel resistances, and shotcrete resistance values. Any additional subsurface borings, laboratory work, or other subsurface data collected for the design shall also be included.
- Soil nail critical cross-section(s) including soil/rock strata, piezometric levels, and location, magnitude, and direction of applied loads.
- Values and associated load factors used in design for pullout resistance, surcharges, soil/rock unit weights, nail head strengths, and strengths of steel, shotcrete, and concrete materials. Global stability soil resistance/load factors used in LRFD verifications.
- Seismic design coefficient and other seismic design criteria applicable for the geographic area of the project.
- Design calculation sheets with the project number, structure location, designation, date of preparation, initials of designer and checker, and page number at the top of each page. Provide an index page with the design calculations.

- Design notes including an explanation of symbols and computer programs used in the design.
- Other design calculations. [Other items may include drainage evaluation and items not considered above.]

B.5.2.b Design Drawings

Design Drawings shall include all information required for the construction and quality control of the work. Design Drawings shall include, but not be limited to, the following items unless provided in the Contract Plans:

1. A plan view of the structure(s) identifying:
 - a. A reference baseline and elevation datum.
 - b. The offset from the construction centerline or baseline to the slope at its base at all changes in horizontal alignment.
 - c. Beginning and end station of reinforced slope.
 - d. Soil nail locations.
 - e. Right-of-way and permanent or temporary construction easement limits, location of all known active and abandoned existing utilities, adjacent structures or other potential interferences. The centerline of any drainage structure or drainage pipe behind, passing through, or passing under the reinforced slope.
 - f. Subsurface exploration locations shown on a plan view of the proposed reinforced slope alignment with appropriate reference base lines to fix the locations of the explorations relative to the structure(s).
 - g. Limit of longest nails.
2. An elevation view of the structure(s) identifying:
 - a. The elevation at the top of the slope, at all horizontal and vertical break points, and at least every 50 feet along the slope.
 - b. Elevations at the base of the slope.
 - c. Soil-nail elevations, vertical and horizontal spacing, and the location of drainage elements.
 - d. Existing and finished grade profiles both behind and in front of the slope.
3. All necessary cross-section(s) to construct the reinforced slope.
4. General notes for constructing the soil nails including construction sequencing or other special construction requirements.
5. Design parameters and applicable codes.
6. Horizontal and vertical curve data affecting the slope and control points, including match lines or other details to relate to slope stationing to centerline stationing.
7. A listing of the summary of quantities on the elevation drawing of each slope showing the estimated surface area [expressed in square feet].
8. Nail reinforced slope typical sections including grade, nail spacing and inclination, sizes of nail bars (also referred to as tendons), and corrosion protection details.
9. Typical details of production and test nails defining the nail length, minimum drill hole diameter, inclination, and test nail bonded and unbonded test lengths.
10. Details, dimensions, and schedules for all nails, reinforcing steel, wire mesh, bearing plates, headed studs, etc. and/or attachment devices for shotcrete, cast-in-place or prefabricated facings.

11. Dimensions and schedules of all reinforcing steel including reinforcing bar bending details.
12. Details and dimensions for all appurtenances such as barriers, coping, drainage gutters, fences, etc.
13. Details for constructing slope around drainage facilities.
14. Details for terminating reinforced slope and adjacent slope construction.

B.5.3 Construction Submittals

B.5.3.a Construction Plan

At least 30 calendar days before starting the soil nail work, the contractor shall submit a Construction Plan to the owner's engineer that includes the following:

1. Project start date and proposed detailed reinforced slope construction sequence.
2. Drilling and grouting methods and equipment, including the drill hole diameter proposed to achieve the specified nominal pullout resistance values and any variation of these along the slope alignment.
3. Nail grout mix design, including compressive strength test results (per AASHTO T106/ASTM C109) supplied by a qualified independent testing lab verifying the specified minimum 3-day and 28-day grout compressive strengths. For neat cement grout include specific gravity test results of the fresh grout used for compressive testing.
4. Nail grout placement procedures and equipment.
5. Soil nail testing methods and equipment setup.
6. Identification number and certified calibration records for each test jack, pressure gauge, dial gauge, and load cell to be used. Jack and pressure gauge shall be calibrated as a unit. Calibration records shall include the date tested, the device identification number, and the calibration test results, and shall be certified for an accuracy of at least 2 percent of the applied certification loads by a qualified independent testing laboratory within 90 calendar days prior to submittal.
7. Manufacturer's Certificates of Compliance for materials including: ultimate strength of the tendon, Portland cement, centralizers, bearing plates, epoxy coating, and encapsulation.
8. The owner's engineer shall approve or reject the contractor's construction plan within 15 calendar days of receipt of the submission. Approval of the construction plan does not relieve the contractor of his responsibility for the successful completion of the work.

B.6.3.b Monitoring Plan

At least 30 calendar days before starting the soil nail work, the contractor shall submit a monitoring plan, if applicable for the project, to the owner's engineer for approval. The owner's engineer shall approve or reject the contractor's monitoring plan within 14 calendar days of receipt of the submission.

C Construction

C.1 Storage

Tendons shall be stored and handled in a manner to avoid damage or corrosion. Tendons exhibiting abrasions, cuts, welds, weld splatter, corrosion, or pitting shall be replaced. Bars exhibiting damage to encapsulation or epoxy coating shall be repaired or replaced at no additional cost.

C.2 Soil Nail Installation

Drill holes for the soil nails shall be drilled at the locations, elevations, orientations, and lengths shown on the approved design drawings. The drilling equipment and methods shall be selected by contractor to be suitable for the ground conditions and according to the accepted installation methods submitted by the contractor.

C.3 Protection of Adjacent Structures

Installation of Reinforced Soil Nail Slope is to be completed before work commences on adjacent improvements located within a horizontal distance equal to the length of the longest soil nail.

C.4 Soil Nail Testing

C.4.1 Tests

The contractor shall perform both verification and proof testing of designated test soil nails. Verification tests on sacrificial test nails shall be conducted at locations shown on the approved design drawings. Proof tests on production nails shall be conducted at locations selected by the owner's Engineer. Testing of any nail shall not be performed until the nail grout has cured for at least 72 hours or attained at least their specified 3-day compressive strength. The contractor shall not apply loads greater than 80 percent of the minimum guaranteed ultimate tensile strength of the tendon for Grade 150 bars or 90 percent of the minimum guaranteed ultimate tensile strength of the tendon for Grade 60 or 75 bars. Preliminary results shall be submitted to the owner and/or owner's engineer within 24 hours of the test completion. A full report containing test load results shall be submitted to the owner and/or owner's engineer within 5 working days of the test completion.

Refer to FHWA Geotechnical Circular No. 7 "Soil Nail Walls," Chapter 9, for detailed guidance on soil nail testing.

C.4.2 Verification Testing

The contractor shall perform a number of verification tests on sacrificial soil nails as established in the design drawings. Verification testing shall be conducted prior to installation of production soil nails on sacrificial soil nails to confirm the appropriateness of the contractor's drilling and installation methods, and verify the required nail pullout resistance.

The maximum test load in verification tests (VTL) shall be calculated based on as-built bonded lengths per FHWA Geotechnical Circular No. 7 "Soil Nail Walls," Chapter 9. The Load Schedule for Verification Testing shall comply with FHWA Geotechnical Circular No. 7 "Soil Nail Walls," Chapter 9.

C.4.3 Proof Testing

Successful proof testing shall be demonstrated on at least 5 percent of production soil nails in each nail row or a minimum of one per row. The owner's Engineer shall determine the locations and number of proof tests prior to nail installation in each row. [The quantity of proof tests should be established by the owner prior to bidding.] Verification tests shall not be counted towards the minimum of 5 percent of production nails.

The maximum test load in proof tests (PTL) shall be calculated based on as-built bonded lengths per FHWA Geotechnical Circular No. 7 “Soil Nail Walls,” Chapter 9. The Load Schedule for Proof Testing shall comply with FHWA Geotechnical Circular No. 7 “Soil Nail Walls,” Chapter 9.

C.5 Acceptance Criteria

C.5.1 Verification Tests

1. Considering that pullout is defined as the load at which attempts to further increase the test load increments simply result in continued movement of the tested nail, a test nail shall be considered acceptable when all of the following criteria are met.
2. The total creep movement is less than 0.08 in. between the 6- and 60-minute readings, and the creep rate is linear or decreasing throughout the creep test load hold period.
3. The total movement (ΔVTL) measured at VTL exceeds 80 percent of the theoretical elastic elongation of the unbonded length of the test nail, as defined in FHWA Geotechnical Circular No. 7 “Soil Nail Walls,” Chapter 9.
4. Pullout does not occur before achieving $1.0 \times VTL$.

C.5.2 Proof Tests

1. The creep movement between the 1- and the 10-minute readings is less than 0.04 in.
2. In cases when the creep movement between the 1- and the 10-minute readings is greater than 0.04 in., the creep movement between the 6- and the 60-minute readings is less than 0.08 in., and the creep rate is linear or decreasing throughout the creep test load hold period.
3. The total soil nail movement (ΔPTL) measured at PTL exceeds 80 percent of the theoretical elastic elongation of the unbonded length, as defined in FHWA Geotechnical Circular No. 7 “Soil Nail Walls,” Chapter 9.
4. Pullout does not occur before the test load is $1.0 \times PTL$.
5. The temporary unbonded test length in proof tests is successfully maintained for subsequent satisfactory grouting. If the unbonded test length of production proof test nails cannot be satisfactorily grouted after testing, the proof test nail shall become sacrificial and shall be replaced with an additional production nail installed at no additional cost to the owner.

C.6 Rejection of Test Soil Nails

C.6.1 Verification Test Soil Nails

The owner’s Engineer will evaluate the results of each verification test. Installation methods that do not satisfy the nail testing requirements shall be rejected. The contractor shall propose alternative methods for review by the owner’s engineer and shall install replacement verification test nails. Replacement test nails shall be installed and tested at no additional cost.

C.6.2 Proof Test Soil Nails

For proof test nails, the owner’s engineer may require the contractor to replace some or all of the installed production nails between a failed proof test soil nail and the adjacent passing proof test nail. Alternatively, the owner’s engineer may require the installation and testing of additional proof test nails to verify that adjacent previously installed production nails have sufficient nominal pullout resistance. Installation and testing of additional proof test nails or

installation of additional or modified nails as a result of proof test nail failure(s) shall be at no additional cost.

C.7 Corrosion Protection

Soil nails and soil nail head components shall be protected against corrosion consistent with the ground and groundwater conditions at the site and the minimum class of corrosion protection shown on contract plans.

C.8 Surface Finish

Soil nails, soil nail heads and installation methods for reinforced slope shall be compatible with a natural vegetative cover. See Erosion Control Plan for details of vegetated surface.

D Measurement

The department will measure Soil Nail Reinforced Slope by the square foot of surface area along the slope, 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.0165.04	Soil Nail Reinforced Slope	SF

Payment is full compensation for design and construction inclusive of all soil nail costs, including design, materials, installation, excavation, testing and monitoring, as described on Contract Plans, this Specification and Design Drawings.

83. Concrete Pavement 8-inch Colored, Item SPV.0180.01.**A Description**

This special provision describes constructing colored concrete pavement, according to standard spec 405 and standard spec 415, as shown on the plans, and hereinafter provided.

B Materials

Colorant shall be applied to provide a finished concrete color of charcoal gray, FS#24091 according to Federal 595C color index.

C (Vacant)**D Measurement**

The department will measure Concrete Pavement 8-inch Colored in square yards of surface area, 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.0180.01	Concrete Pavement 8-inch Colored	SY

Payment is full compensating for preparing the foundation; for furnishing, hauling, preparing, coloring, placing, curing, and protecting the concrete: for jointing and joint materials, dowels, and tied bars; for measuring opening strength including fabricating and testing cylinders, obtaining and testing cores, and evaluating maturity; for measuring pavement thickness, except as specified in standard spec 415.3.18.7; and for filling all core holes, and incidentals necessary to complete the contract work.

84. Wet Mesic Prairie, Item SPV.0180.02.**A Description**

Furnish and install a wet mesic prairie at the locations shown on the plans, and according to the requirements of standard spec 630, the plans, and as hereinafter provided.

B Materials

Furnish seed at the amount shown on the Seeding Schedule in the plans.

C Construction

Install Wet Mesic Prairie as indicated on the plans, according to standard specifications and according to certified native planting nursery's specifications or as directed by the engineer. Work is to be performed by a contractor with at least 5 years' of experience in native seeding and landscaping operations.

D Measurement

The department will measure Wet Mesic Prairie in area by the square yard of prairie, acceptably installed and 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.0180.02	Wet Mesic Prairie	SY

Payment is full compensation for furnishing and planting all plant materials; preparing the planting area; preparing the seed; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

85. Sod – Kentucky Blue and Fescue Mix, Item SPV.0180.03.**A Description**

Furnish and install sod that consists of a mix of Kentucky Blue and Fescue Mix at the locations shown on the plans and according to the requirements of standard spec 631, the plans, and as hereinafter provided.

B Materials

Provide a Kentucky Bluegrass and Fescue sod material as per the standard specifications.

C Construction

Install sod as shown on the plan and according to the standard specifications.

D Measurement

The department will measure Sod – Kentucky Blue and Fescue Mix in area by the square yard of installation, 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.0180.03	Sod – Kentucky Blue and Fescue Mix	SY

Payment is full compensation for furnishing and installing all materials; for preparing the ground surface before placing the sod; all rolling and watering to establish the sod; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

86. Mississippi River Rock, Item SPV.0195.01.

A Description

Furnish and install Mississippi River Rock at the locations shown on the plans, and according to the requirements of standard spec 627, 612 and 645, the plans, and as hereinafter provided.

B Materials

Furnish the following:

- 3/4-inch diameter washed Mississippi River Rock
- Geotextile Fabric, Type SAS

C Construction

Install Mississippi River Rock as shown on the plan and according to the standard specifications.

D Measurement

The department will measure Mississippi Rock River by the ton of rock, acceptably furnished and installed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0195.01	Mississippi River Rock	Ton

Payment is full compensation for furnishing and installing the river rock, fabric, and drain pipe; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

**ADDITIONAL SPECIAL PROVISION 1 (ASP 1)
FOR TRANSPORTATION ALLIANCE FOR NEW SOLUTIONS (TrANS)
PROGRAM EMPLOYMENT PLACEMENTS AND APPRENTICESHIPS**

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Section 5204(e) – Surface Transportation Workforce Development Training and Education, provides for 100 percent Federal funding if the core program funds are used for training, education, or workforce development purposes, including “pipeline” activities. The core programs includes: Congestion Mitigation and Air Quality Improvement (CMAQ) Program, Highway Bridge Program (HBP), Interstate Maintenance (IM), National Highway System (NHS), and Surface Transportation Program (STP). These workforce development activities cover surface transportation workers, including OJT/SS programs for women and minorities as authorized in 23 U.S.C. §140(b).

TrANS is an employment program originally established in 1995 in Southeastern Wisconsin. Currently TrANS has expanded to include TrANS program locations to serve contractors in Southeast (Milwaukee and surrounding counties), Southcentral (Dane County and surrounding counties including Rock County), and most Northeastern Wisconsin counties from locations in Keshena, Rhinelander and surrounding far Northern areas. TrANS attempts to meet contractor’s needs in other geographic locations as possible. It is an industry driven plan of services to address the outreach, preparation, placement and retention of women, minorities and non-minorities as laborers and apprentices in the highway skilled trades. These candidate preparation and contractor coordination services are provided by community based organizations. For a list of the TrANS Coordinators contact the Disadvantaged Business Enterprise Office at (414) 438-4583 in Milwaukee or (608) 266-6961 in Madison. These services are provided to you at no cost.

I. BASIC CONCEPTS

Training reimbursements to employing contractors for new placements, rehires or promotions to apprentice of TrANS Program graduates will be made as follows:

- 1) **On-the-Job Training, Item ASP.1T0G, ASP 1 Graduate.** At the rate of \$5.00 per hour on federal aid projects when TrANS graduates are initially hired, or seasonally rehired, as unskilled laborers or the equivalent.

Eligibility and Duration: To the employing contractor, for up to 2000 hours from the point of initial hire as a TrANS program placement.

Contract Goal: To maintain the intent of the Equal Employment Opportunity program, it is a goal that 0 (number) TrANS Graduate(s) be utilized on this contract.

- 2) **On-the-Job Training, Item ASP.1T0A, ASP 1 Apprentice.** At the rate of \$5.00 per hour on federal aid projects at the point when an employee who came out of the TrANS Program is subsequently entered into an apprenticeship contract in an underutilized skilled trade (this will include the Skilled Laborer Apprenticeship when that standard is implemented).

Eligibility and Duration: To the employing contractor, for the length of time the TrANS graduate is in apprentice status.

Contract Goal: To maintain the intent of the Equal Employment Opportunity program, it is a goal that 1 (number) TrANS Apprentice(s) be utilized on this contract.

- 3) The maximum duration of reimbursement is two years as a TrANS graduate plus time in apprentice status.
- 4) If a TrANS program is not available in the contractor's area and another training program is utilized, payment of On-the-Job Training hours may be approved by the Wisconsin Department of Transportation (WisDOT) if the training program meets the established acceptance criteria. Only On-the-Job Training Hours accumulated after WisDOT approval will be reimbursed as specified under Items ASP.1T0G and ASP.1T0A. For more information, contact the Disadvantaged Business Enterprise Office at the phone numbers listed above.
- 5) WisDOT reserves the right to deny payments under items ASP.1T0G and ASP.1T0A if the contractor either fails to provide training or there is evidence of a lack of good faith in meeting the requirements of this training special provision.

I. RATIONALE AND SPECIAL NOTE

The \$5.00 per hour now being paid for TrANS placements is intended to cover the duration of two years to allow for reaching entry-level laborer status. An additional incentive, the \$5.00 rate, would promote movement into the underutilized skilled trades' apprenticeships and applies until the individual completes their apprenticeship. These incentives benefit TrANS candidates by giving them a better opportunity to enter a skilled trade; benefits contractors who will be assisted in meeting their EEO profiles and goals; and benefits the public who will see the program reinforce larger public-private employment reform in Wisconsin. The pool of TrANS graduates was created for the purpose of addressing underutilization in the skilled trades, an objective that is further reinforced by a parallel retention pilot program, known as the Companywide Reporting. *Whether or not reimbursement is involved, the WisDOT reassures contractors who are in the Companywide Program that TrANS placements still contribute toward fulfilling the new hire goal of 50% women and minorities.* Based on data administered by United States Department of Labor (US DOL), the highway skilled trades remain underutilized for women statewide (less than 6.9%); and for minorities in all counties (% varies by county).

NOTE: *Unless using other advancement strategies, contractors are encouraged to use some or all of this monetary incentive to offset the cut in hourly wages an individual may incur when entering an apprenticeship if the full general laborer hourly rate has been previously paid. No special accounting measures are required.*

II. IMPLEMENTATION

The implementation of ASP 1 is intended to cover only the amount of time it takes for underutilization to be resolved across the trades. This will be measured annually at the county and/or state levels using data administered by WisDWD in relation to goals set by the USDOL-

OFCCP. With appropriate state and federal approvals, we may also do some measurement at the company level.

It is the contractor's responsibility to note on their Certified Payrolls if their employee is a TrANS graduate or a TrANS apprentice. The District EEO Coordinators utilize the information on the Certified Payrolls to track the hours accumulated by TrANS Graduates and TrANS apprentices on WisDOT contracts. Payment under this ASP 1 is made based on the hours recorded off of the Certified Payrolls. Tracking may eventually include improved linkages with the WisDWD apprentice database, information from company and committee level sources.

TrANS is nondiscriminatory by regulation, and is a tool for optional use by contractors to address the underutilization of women and minorities as laborers and apprentices in our industry's skilled trades.

IV. TRANS TRAINING

As part of the contractor's equal employment opportunity affirmative action program, training shall be provided to employees enrolled in apprenticeship and on-the-job training programs as follows:

The contractor shall provide on-the-job training aimed at developing full journey workers in the type of trade or job classifications involved. In the event the contractor subcontracts a portion of the contract work, the contractor shall determine how many, if any, of the trainees are to be trained by the subcontractor provided, however, that the contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The contractor shall also insure that this training special provision is made applicable to such subcontract.

Training and upgrading of minorities and women toward journey workers status is a primary objective of this training special provision. Accordingly, the contractor shall make every effort to enroll minority trainees and women (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority trainees and women trainees); to the extent such persons are available within a reasonable area of recruitment. The contractor will be given an opportunity and will be responsible for demonstrating the steps that they have taken in pursuance thereof, prior to determination as to whether the contractor is in compliance with this training special provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which they have successfully completed a training course leading to journey workers status or in which they have been employed as a journey worker. The contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used, the contractor's records should document the findings in each case.

V. APPRENTICESHIP TRAINING

The Federal Highway Administration's (FHWA) policy is to require full use of all available training and skill improvement opportunities to assure increased participation of minority groups, disadvantaged persons and women in all phases of the highway construction industry. The FHWA On-the-Job Training (OJT) Program requires the State transportation agencies (STAs) to establish apprenticeships and training programs targeted to move women, minorities, and disadvantaged individuals into journey-level positions to ensure that a competent workforce is available to meet highway construction hiring needs, and to address the historical underrepresentation of members of these groups in highway construction skilled crafts.

The OJT Supportive Services (OJT/SS) Program was established in Title 23 Code of Federal Regulations (CFR), Part 230) to supplement the OJT program and support STA training programs by providing services to highway construction contractors and assistance to highway construction apprentices and trainees. The primary objectives of OJT/SS are:

- (1) To increase the overall effectiveness of the State highway agencies' approved training programs.
- (2) To seek other ways to increase the training opportunities for women, minorities, and disadvantaged individuals.

The STAs are responsible for establishing procedures, subject to the availability of Surface Transportation and Bridge Funds under 23 U.S.C. §140(b) (Nondiscrimination), for the provision of supportive services with respect to training programs approved under 23 CFR, Part 230(a) (Equal Employment Opportunity on Federal and Federal-aid Construction Contracts – including Supportive Services).

The contractor and subcontractor shall maintain records to demonstrate compliance with these apprenticeship requirements. Reasonable exemptions and modifications to and from any or all of these requirements will be determined by the Wisconsin Department of Transportation-Civil Rights Office. A request for an exemption or modification, with justification, shall be made in writing, addressed to WisDOT Civil Rights Office, 4802 Sheboygan Avenue, P.O. Box 7965, Rm. 451, Madison, WI 53707.

ADDITIONAL SPECIAL PROVISION 3 DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

1. Description

General

- a. The disadvantaged business enterprise (DBE) requirements of 49 CFR Part 26 apply to this contract. The department's DBE goal is shown on the cover of the bidding proposal. The contractor can meet the specified contract DBE goal by procuring services or materials from a DBE or by subcontracting work to a DBE. The department calculates the DBE participation as the dollar value of DBE participation included in the bid expressed as a percentage of the total contract bid amount.
- b. Under the contract, the contractor agrees to provide the assistance to participating DBE's in the following areas:
 - i. Produce accurate and complete quotes.
 - ii. Understand highway plans applicable to their work.
 - iii. Understand specifications and contract requirements applicable to their work.
 - iv. Understand contracting reporting requirements.
- c. The department encourages the contractor to assist and develop DBE firms to become fully knowledgeable contractors to successfully perform on its contracts.
- d. For information on the disadvantaged business program, visit the department's Civil Rights and Compliance Section website at:

<http://wisconsindot.gov/Pages/doing-bus/civil-rights/dbe/default.aspx>

2. Definitions

- a. Interpret these terms, used throughout this additional special provision, as follows:
 - i. **Bid Percentage:** The DBE percentage indicated in the bidding proposal at the time of bid.
 - ii. **DBE:** A disadvantaged business enterprise (DBE) certified as a DBE by the department and included on the department's list of certified DBE's who are determined to be ready, willing and able.
 - iii. **DBE goal:** The amount of DBE participation expected in the contract as shown on the cover of the Highway Work Proposal.
 - iv. **Discretionary Goal:** A contractor assigned DBE goal, typically abbreviated as "Disc" on the cover of the Highway Work Proposal, which is enforced as committed.
 - v. **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.
 - vi. **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.
 - vii. **Voluntary Achievement:** The amount of DBE participation achieved and reported in the contract in excess of the assigned goal.

3. DBE Percentage Required at Bid Submission

Indicate the bid percentage (i.e. 0% through 100%) of DBE participation on the completed bidding proposal, including projects with discretionary goals. For electronic submittals, show the percentage in the miscellaneous data folder, Item 3, DBE Percent. For paper submittals, show the percentage on the sheet included after the schedule of items. By submission of the bid, the bidder contractually

commits to DBE participation at or above the bid percentage, or certifies that they have utilized comprehensive good faith efforts to solicit and utilize DBE firms to meet the DBE participation requirements of this contract proposal, and that the bid percentage is reflective of these good faith efforts. If the bidder does not indicate the bid percentage of DBE participation on the completed bidding proposal, the department will consider the bid irregular and may reject the bid.

4. Department's DBE Evaluation Process

a. Documentation Submittal

Within 10 business days after the notification of contract award, the contractor is to identify, by name, the DBE firms whose utilization is intended to satisfy this provision, the items of work of the DBE subcontract or supply agreement and the dollar value of those items of work by completing the Commitment to Subcontract to DBE Form [DT1506] and all necessary attachment A forms, as well as, Good Faith Waiver Form [DT1202] and supporting documentation as necessary. If the contractor fails to furnish the required forms within the specified time, the department may cancel the award. Delay in fulfilling this requirement is not a cause for extension of the contract time and shall not be used as a tool to delay execution.

i. Bidder Meets DBE Goal

If the bidder indicates that the contract DBE goal is met, after award and before execution, the department will evaluate the Commitment to Subcontract to DBE Form DT1506 and attachment A(s) to verify the actual DBE percentage achieved. If the DBE commitment is verified, the contract is eligible for execution with respect to the DBE commitment.

ii. Bidder Does Not Meet DBE Goal

- (1) If the bidder indicates a bid percentage on the Commitment to Subcontract to DBE Form [DT1506] that does not meet the contract DBE goal, the bidder must submit a Good Faith Waiver Form [DT1202] and supporting documentation. After award and before execution, the department will evaluate the bidder's DBE commitment and consider the bidder's good faith waiver request.
- (2) The department will review the bidder's good faith waiver request and notify the bidder of one of the following:
 - a. If the department grants a good faith waiver, the bid is eligible for contract execution with respect to DBE commitment.
 - b. If the department rejects the good faith waiver request, the department may declare the bid ineligible for execution. The department will provide a written explanation of why the good faith waiver request was rejected. The bidder may appeal the department's rejection as allowed under 7 a. & b.

5. Department's Criteria for Good Faith Effort

The Code of Federal Regulations {CFR}, 49 CFR Part 26-Appendix A, is the guiding regulation concerning good faith efforts. However, the federal regulations do not define "good faith" but states that bidder must actively and aggressively attempt to meet the goal. The federal regulations are general and do not include every factor or effort that can be considered. As a result, each state must establish its own processes and consider the factors established in its own process when making a determination of good faith.

- a. The department will only grant a good faith waiver if the bidder has made the effort, given the relevant circumstances under the contract that a bidder actively and aggressively seeking to meet the goal would make. The department will evaluate the bidder's good faith effort to determine whether a good faith waiver will be granted. The bidder must demonstrate, on the DT1202 that they

have aggressively solicited DBE participation in an attempt to meet the contract DBE goal and attaining the stated DBE goal is not feasible.

- b. The department, in conjunction with industry stakeholders, has developed the following guidance for contractor good faith effort. 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.
- c. Prime Contractors should:
 - i. Document all efforts and decisions made toward achieving the DBE goal on the contract. The bidder should use the Civil Rights & Compliance System [CRCS] and related WisDOT-approved DBE outreach tools, including the Bid Express Small Business Network, to foster DBE participation on all applicable contracts.
 - ii. Request quotes by identifying potential items to subcontract and solicit. Prime contractors are strongly encouraged to include in their initial contacts a single page including a 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 A.* 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's to do work in a prime contractor's area of specialization.
 - (1) Solicit quotes through all reasonable and available means from certified DBE firms who match 'possible items to subcontract' and send copies to DBESS office, highlighting areas in which you are seeking quotes. Email is acceptable.
 - (2) SBN is the preferred outreach tool. <https://www.bidx.com/wi/main> Other acceptable means include postal mail, email, fax, phone call.
 - a. Primes must ask DBE firms for a response in their solicitations. See *Sample Contractors Solicitation Letter* in Appendix. This letter can be included as an attachment to the SBN sub-quote request.
 - b. Solicit quotes at least 10 calendar days prior to the letting date {ideally two Fridays before the letting} to allow DBE firms sufficient time to respond. Prime contractors should contact DBE firms early, asking them if they need help in putting together a quote, or helping to arrange for equipment needs, or solve other problems.
 - (3) Second solicitation should take place within 5 days
 - a. An email solicitation is highly recommended for this second solicitation
 - (4) 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.
 - (5) When potential exists, advise interested DBE firms on how to obtain bonding, line of credit or insurance as may be requested.
 - (6) 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. Copy of the DBE quotes
 - e. Signed copy of Bid Express SBN Record of Subcontractor Outreach Effort.

- d. Evaluate DBE quotes as documentation is critical if the prime does not utilize the DBE firm's quote for any reason.
- i. Evaluate DBE firm's capability to perform 'possible items to subcontract' using legitimate reasons, including but not limited to, **a discussion with the DBE firm** regarding its capabilities prior to the bid letting. If lack of capacity is your reason for not utilizing the DBE quote, you are required to contact the DBE directly regarding their ability to perform the work indicated in the UCP directory as their work area [NAICS code]; only the work area and/or NAICS code listed in the UCP directory will be counted for DBE credit. Documentation of the conversation is required.
 - ii. In striving to meet a DBE conscious contract goal, prime contractors are expected to use DBE quotes that are responsive and reasonable. This includes DBE quotes that are not the low quote.
 - iii. **Special Circumstance:** Evaluation of DBE quotes with tied bid items. "Tied quotes are the condition in which a subcontractor submits quotes including multiple areas of expertise across multiple work areas noting that the items and price are tied. Typically this type of quoting represents a cost saving to the prime but is not clearly stated as a discount; tied quotes are usually presented as 'all or none' quote to the prime." When non-DBE subcontractors submit tied bid items in their quotes to the prime, the DBE firms' quote may seem not competitive. In such a case, the following steps are taken in comparing the relevant quotes. These are qualitative examples.
 - (1) Compare bid items common to both quotes, noting the reasonableness in the price comparison.
 - (2) 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.
- e. After notification of contract award, submit '**Commitment to Subcontract**' form within the time period specified in the contract.
- i. Provide the following information along with department form DT1202:
 - (1) The names, addresses, e-mail addresses, telephone numbers of DBE's contacted. The dates of both initial and follow-up contact. A printed copy of SBN solicitation is acceptable.
 - (2) A description of information provided to the DBE's regarding the plans, specifications, and estimated quantities for portions of the work to be performed by that DBE.
 - (3) Photocopies or electronic copies of all written solicitations to DBE's.
 - (4) Documentation of each quote received from a DBE and, if rejected, the reason for that rejection.
 - (5) Bidder attendance at any pre-solicitation or pre-bid meetings the department held to inform DBE's of participation opportunities available on the project.
- f. The department's DBE Support Services Office is available by phone, email or in writing to request assistance in meeting the DBE goal:

DBE Support Services Office
6150 Fond du Lac Ave.
Milwaukee, WI 53218
Phone: 414-438-4583 / 608-266-6961
Fax: 414-438-5392
E-mail: DOTDBESupportServices@dot.wi.gov

6. Bidder's Appeal Process

- a. A bidder can appeal the department's decision to deny the bidder's good faith waiver request. The bidder must provide written documentation refuting the specific reasons for rejection as stated in the department's rejection notice. The bidder may meet in person with the department if so requested. Failure to appeal within 7 calendar days after receiving the department's written notice of rejection of a good faith waiver request under constitutes a forfeiture of the bidder's right of appeal. If the bidder does not appeal, the department may declare the bid ineligible for execution.
- b. The department will appoint a representative, who did not participate in the original determination, to assess the bidder's appeal. The department will issue a written decision within 7 calendar days after the bidder presents all written and oral testimony. In that written decision, the department will explain the basis for finding that the bidder did or did not meet the contract DBE goal or make an adequate good faith effort to meet the contract DBE goal. The department's decision is final. If the department finds that the bidder did not meet the contract DBE goal or did not make adequate efforts to meet the DBE goal, the department may declare the bid ineligible for execution.

7. Department's Criteria for DBE Participation

Department's DBE List

- a. The department maintains a DBE list on the department's website
<http://wisconsindot.gov/Documents/doing-bus/civil-rights/dbe/ucp-directory.xlsx>
- b. The DBE office is also available to assist at 414-438-4583 or 608-266-6961.

8. Counting DBE Participation

Assessing DBE Work

- a. 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 unified certification program agencies. If a firm becomes DBE certified before entering into a subcontract, the department may consider that DBE usage towards the contract goal. 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:
- b. The department counts work performed by the DBE's own resources. The department includes the cost of materials and supplies the DBE obtains for the work. The department also includes the cost of equipment the DBE leases for the work. The department will not include the cost of materials, supplies, or equipment the DBE purchases or leases from the prime contractor or its affiliate, except the department will count non-project specific leases the DBE has in place before the work is advertised.
- c. The department counts fees and commissions the DBE charges for providing a 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 engineer deems reasonable based on experience or prevailing market rates.
- d. If a DBE subcontracts work, the department counts the value of the subcontracted work only if the DBE's subcontractor is also a DBE.
- e. The contractor shall maintain records and may be required to furnish periodic reports documenting its performance under this item.
- f. It is the prime contractor's responsibility to determine the DBE's ability to perform the work with the use of the UCP directory.

9. Commercially Useful Function

- a. The department counts expenditures of a DBE toward the DBE goal only if the DBE is performing a commercially useful function on that contract.
- b. A DBE is performing a commercially useful function if the following conditions are met:
- c. For contract work, the DBE is responsible for executing a distinct portion of the contract work and it is carrying out its responsibilities by actually performing, managing, and supervising that work.
- d. For materials and supplies, the DBE is responsible for negotiating price, determining quality and quantity, ordering, and paying for those materials and supplies.

10. Trucking

All bidders are expected to adhere to the department's current trucking policy posted on the HCCI website

<http://wisconsindot.gov/Documents/doing-bus/civil-rights/dbe/trucking-utilization-policy.pdf>

11. Manufacturers and Suppliers

The department counts material and supplies a DBE provides under the contract. The department will give full credit toward the DBE goal if the DBE is a manufacturer of those materials or supplies. The department will give 60 percent credit toward the DBE goal if the DBE is merely a supplier of those materials or supplies. It is the bidder's responsibility to find out if the DBE is considered a supplier or a manufacturer before listing them on Commitment to Subcontract to DBE form DT1506.

12. DBE Prime

If the prime contractor is a DBE, the department will only count the work the contractor performs with its own forces, the work DBE subcontractors perform, and the work DBE suppliers or manufacturers perform.

13. Joint Venture

If a DBE performs as a participant in a joint venture, the department will only count that portion of the total dollar value of the contract equal to that portion of the work that the DBE performs with its own forces.

14. 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. On every other project that the mentor protégé team identifies itself on.
- c. For no more than one half of the total contracted DBE goal on any WisDOT project.

15. DBE Replacement

In the event a Prime Contractor needs to replace a DBE firm originally listed on the approved DBE Commitment Form DT1506, the Prime Contractor must comply with the department's DBE Replacement Policy located on the DBE page on the following web site:

<http://wisconsindot.gov/Documents/doing-bus/civil-rights/dbe/policy-statement.pdf>

16. Changes to the approved DBE Commitment Form DT1506

If there are any changes to the approved Commitment to Subcontract to DBE Form DT1506, the prime contractor must submit a revised DBE Commitment Form DT1506 and relevant attachment A(s) to the DBE Programs Office within 5 business days.

17. Contract Modifications

When additional opportunity is available by contract modifications, the Prime Contractor shall utilize DBE Subcontractors that were committed to equal work items, in the original contract.

18. Payment

Costs for conforming to this Additional Special Provision (ASP) and any associated DBE requirements are incidental to the contract.

APPENDIX A
Sample Contractor Solicitation Letter Page 1
This sample is provided as a guide not a requirement

GFW SAMPLE MEMORANDUM

TO: DBE FIRMS
FROM: POTENTIAL PRIME CONTRACTOR OR MAJOR SUBCONTRACTOR
SUBJECT: REQUEST FOR DBE QUOTES
LET DATE & TIME
DATE: MONTH DAY YEAR
CC: DBE OFFICE ENGINEER

Our company is considering bidding on the projects indicated on the next page, as a prime and/or a subcontractor for the Wisconsin Department of Transportation Month- date -year Letting. Page 2 lists the projects and work items that we may subcontract for this letting. We are interested in obtaining subcontractor quotes for these projects and work categories. Also note that we are willing to accept quotes in areas we may be planning to perform ourselves as required by federal rules.

Please review page 2, respond whether you plan to quote, highlight the projects and work items you are interested in performing and return it via fax or email within 3 days. Plans, specifications and addenda are available through WisDOT at the DBE Support Services office or at the Highway Construction Contract Information (HCCI) site at <http://roadwaystandards.dot.wi.gov/hcci/>

Your quote should include all of the costs required to complete the items you propose to perform including labor, equipment, material, and related bonding or insurance. The quote should note items that you are DBE certified to perform, tied items, and any special terms. Page 2, with the indicated projects and items you plan to quote, should be used as a cover sheet for your quote.

Please make every effort to have your quotes into our office by time deadline the prior to the letting date. **Make sure the correct letting date, project ID and proposal number, unit price and extension are included in your quote.** We prefer quotes be sent via SBN but prime's alternative's are acceptable. Our office hours are include hours and days. Please call our office as soon as possible prior to the letting if you need information/clarification to prepare your quote at contact number.

If you wish to discuss or evaluate your quote in more detail, contact us after the contract is awarded. Status of the contract can be checked at WisDOT's HCCI site at <http://roadwaystandards.dot.wi.gov/hcci/>

All questions should be directed to:

Project Manager, John Doe,
Phone: (000) 123-4567
Email: Joe@joetheplumber.com
Fax: (000) 123- 4657

Sample Contractor Solicitation Letter Page 2

This sample is provided as a guide not a requirement

REQUEST FOR QUOTATION

Prime's Name: _____

Letting Date: _____

Project ID: _____

Please check all that apply

- ☐ Yes, we will be quoting on the projects and 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 some one contact me at this number

Prime Contractor's Contact Person

Phone: _____
Fax: _____
Email: _____

DBE Contractor Contact Person

Phone: _____
Fax: _____
Email: _____

Please circle the jobs and items you will be quoting below

Proposal No.	1	2	3	4	5	6	7
County							

WORK DESCRIPTION:

Clear and Grub	X		X	X		X	X
Dump Truck Hauling	X		X	X		X	X
Curb & Gutter/Sidewalk, Etc.	X		X	X		X	X
Erosion Control Items	X		X	X		X	X
Signs and Posts/Markers	X		X	X		X	X
Traffic Control		X	X	X		X	X
Electrical Work/Traffic Signals		X	X	X		X	
Pavement Marking		X	X	X	X	X	X
Sawing Pavement		X	X	X	X	X	X
QMP, Base	X	X		X	X	X	X
Pipe Underdrain	X			X			
Beam Guard				X	X	X	X
Concrete Staining							X
Trees/Shrubs	X						X

Again please make every effort to have your quotes into our office by time deadline prior to the letting date.

We prefer quotes be sent via SBN but prime's preferred alternative's are acceptable.

If there are further questions please direct them to the prime contractor's contact person at phone number.

APPENDIX B BEST PRACTICES FOR PRIME CONTRACTOR & DBE SUBCONTRACTOR GOOD FAITH EFFORT

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 do as thorough a job as possible 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 C

Types of Efforts considered in determining GFE

This list represents concepts being assessed; analysis requires additional steps

1. Whether the contractor attended any pre-solicitation or pre-bid meetings that were scheduled by WisDOT to inform DBEs of contracting and subcontracting opportunities;
2. Whether the contractor provided written notice to a reasonable number of specific DBEs that their interest in the contract was being solicited, in sufficient time to allow the DBEs to participate effectively;
3. Whether the contractor followed up initial solicitations of interest by contacting DBEs to determine if the DBEs were interested; returned the phone calls of interested DBE firms.
4. Whether the contractor selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the DBE goal;
5. Whether the contractor provided interested DBEs with adequate information about the plans, specifications and requirements of the contract;
6. Whether the contractor negotiated in good faith with interested DBEs, not rejected DBEs as unqualified without sound reasons based on a thorough investigation of their capabilities;
7. Whether the contractor made efforts to assist interested DBEs in being more competitive.
8. Whether the contractor effectively used the services of available minority community organizations: minority contractors groups, local, state, and Federal minority business assistance offices, and other organizations that provide assistance to small businesses and DBE firms.
9. Whether Prime used CRCS to identify DBE who specialize in relevant work areas.
10. Whether the contractor used available resources including contacting the DBE office, using WisDOT's website
11. Whether the contractor returned calls of firms expressing interest in a timely manner.

APPENDIX D
Good Faith Effort Evaluation Guidance
Excerpt from Appendix A of 49 CFR Part 26

APPENDIX A TO PART 26 -- GUIDANCE CONCERNING GOOD FAITH EFFORTS

- I. When, as a recipient, you establish a contract goal on a DOT assisted contract, a bidder must, in order to be responsible and/or responsive, make 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, it is up to you 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. 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: meeting quantitative formulas is not required.
- 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. Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBEs who have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBEs to respond to the solicitation. The bidder must 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 to facilitate DBE participation, even when the prime contractor might otherwise prefer to perform these work items with its own forces.
 - 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.

- 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. 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 employee status) are not legitimate causes for the rejection or non solicitation of bids in the contractor's efforts to meet the project goal.
 - 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, you may take into account the performance of other bidders in meeting the contract. 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 reasonable 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.

Appendix E

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 completion at a later time.
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 is a part of the Bid Express® service that was created to ensure that small businesses have a centralized area to access information about upcoming projects. It can help small businesses learn more about opportunities, compete more effectively, network with other contractors and subcontractors, and win more jobs.

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 an 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.
 - b. DBE firms can request a Bid Express Small Business Network Account at no cost by calling 414-438-4588

ADDITIONAL SPECIAL PROVISION 4

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 may also withhold routine 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.

Release of Routine Retainage

After granting substantial completion the department may reduce the routine retainage withheld from the prime contractor to 75 percent of the original total amount retained.

When the Department sends the semi-final estimate the department may reduce the routine retainage withheld from the prime contractor to 10 percent of the original total amount retained.

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 and that no routine retainage is being withheld. The department will pay the prime contractor in full and reduce the routine retainage withheld from the prime contractor to zero when the department approves the final estimate.

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.

ADDITIONAL SPECIAL PROVISION 6

ASP 6 - Modifications to the standard specifications

Make the following revisions to the standard specifications:

550.5.2 Piling

Add the following as paragraph three effective with the December 2015 letting:

- (3) The department will not entertain a change order request for a differing site condition under 104.2.2.2 or for a quantity change under 104.2.2.4.3 for the Piling bid items. Instead the department will adjust pay under the Piling Quantity Variation administrative item if the total driven length of each size is less than 85 percent of, or more than 115 percent of the contract quantity as follows:

Percent of Contract Length Driven	Pay Adjustment
< 85	(85% contract length - driven length) x 20% unit price
> 115	(driven length - 115% contract length) x 5% unit price

643.2.1 General

Replace paragraph two with the following effective with the December 2015 letting:

- (2) Use reflective sheeting from the department's approved products list on barricades, drums, and flexible tubular marker posts.

Errata

Make the following corrections to the standard specifications:

641.2.9 Overhead Sign Supports

Correct errata adding back accidentally deleted paragraphs one through three.

- (1) Provide commercially fabricated overhead sign supports conforming to AASHTO design and fabrication standards for structural supports for highway signs, luminaires, and traffic signals. Use a design life of 50 years with a wind importance factor of 1.00. Design to withstand a 3 second gust wind speed of 90 mph. Do not use the methods of appendix C of those AASHTO standards.
- (2) Design structures, listed as applicable structure types in the AASHTO standards, to the fatigue category criteria as follows:
 1. Structures carrying variable message signs:
 - Category I criteria for structures over all roadway types.
 2. Structures carrying type II or III signs:
 - Category I criteria for structures used over highways and free flow ramps.
 - Category II criteria for structures with arms greater than 30 feet used over local roads and city streets.
 - Category III criteria for structures with arms 30 feet or less used over local roads and city streets.
- (3) Use the posted speed limit of the roadway beneath the structure for truck-induced gusts.
- (4) Submit shop drawings identified by structure number, design computations, and material specifications, to the engineer before erecting sign supports. Provide tightening procedures for mast arm or luminaire arm to pole shaft connections on the shop drawings. Have a professional engineer registered in the state of Wisconsin sign, seal, and date the shop drawings and certify that the design conforms to AASHTO standards and the contract.
- (5) Provide steel pole shafts and mast arms zinc coated according to ASTM A123. Provide tapered pole and arm shafts with a minimum taper of 0.14 inch per foot for single-member vertical and single-member horizontal structure components. Provide bolts and other hardware conforming to 641.2.2.

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. 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).
 6. All agreements made by a contractor shall include the provisions in A(1), (2), (3), (4) and (5), and shall be binding on all first tier subcontractor relationships and all contractors and subcontractors utilizing DBE firms on the project.
- B. Costs for conforming to this special provision are incidental to the contract.

ADDITIONAL SPECIAL PROVISION 9

Electronic Certified Payroll Submittal

(1) Use the department's Civil Rights Compliance System (CRCS) to submit certified payrolls electronically. Details are available online through the department's highway construction contractor information (HCCI) site on the Labor, Wages, and EEO Information page at:

<http://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/default.aspx>

(2) Ensure that all tiers of subcontractors, as well as all trucking firms, submit their weekly certified payrolls electronically through CRCS. These payrolls 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 payrolls. The department will provide training either in a classroom setting at one of our regional offices or by telephone. Contact Tess Mulrooney at 608-267-4489 to schedule the training.

(4) The department will reject all paper submittals of forms DT-1816 and DT-1929 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 data from their computer system into CRCS should have their payroll coordinator send several sample electronic files to Tess two months before a payroll needs to be submitted. Not every contractor's payroll system is capable of producing export files. For details, see pages 17-22 of the CRCS System Background Information manual available online on the Labor, Wages, and EEO Information page at:

<http://wisconsindot.gov/Documents/doing-bus/civil-rights/labornwage/crcs-payroll-manual.pdf>

REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS

- I. General
- II. Nondiscrimination
- III. Nonsegregated 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. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

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 (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).

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.

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). 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 bid proposal or request for proposal 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).

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.

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. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 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 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, 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 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, 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 230, 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 (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 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 35 and 29 CFR 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.

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, 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 who 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.

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, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure 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. 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, 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, 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 there under. 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, 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 and 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. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor 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 contracting agency deems appropriate.

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 \$10,000 or more.

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, 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). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

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

a. All laborers and mechanics employed or working upon the site of the work, 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 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.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions

of paragraph 1.d. 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 shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). 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 classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) shall 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.(1) The contracting officer shall 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 shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore 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 utilized 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) 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 shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. 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.

(3) 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 shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour 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.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall 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.

c. 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 shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. 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, 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.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, 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.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, 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 section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) 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 section 1(b)(2)(B) of the Davis-

Bacon Act, the contractor shall 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. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed 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 Regulations, 29 CFR part 3;

(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 of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, 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 may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed 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 Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall 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 the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly

rate specified in the applicable wage determination. Apprentices shall 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, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. 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. 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 journeymen 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.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 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.

9. Disputes concerning labor standards. 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 he or she) 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 section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

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 watchmen 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.

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. 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 watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 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.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or 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, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

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" 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:

(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.

2. 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. 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.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

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 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.

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 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).

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 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 1, 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

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.

2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

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.

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.

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.

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.

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 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee 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 grantee or subgrantee 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).

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.

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.

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. 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 Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

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. 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) 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;

(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; 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.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. 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)

a. By signing and submitting this proposal, the prospective lower tier 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.

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 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 grantee or subgrantee 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 grantee or subgrantee 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.

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.

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 Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

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.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall 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 20).

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.

**ATTACHMENT A - EMPLOYMENT AND MATERIALS
PREFERENCE FOR APPALACHIAN DEVELOPMENT
HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS
ROAD CONTRACTS**

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.

SEPTEMBER 2002

**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.

APRIL 2013

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.

Effective August 2015 letting

BUY AMERICA PROVISION

All steel and iron materials permanently incorporated in this project shall be domestic products and all manufacturing and coating processes for these materials from smelting forward in the manufacturing process 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 this 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. The contractor shall take actions and provide documentation conforming to CMM 2-28.5 to ensure compliance with this "Buy America" provision.

<http://wisconsindot.gov/rdwy/cmm/cm-02-28.pdf>

Upon completion of the project certify to the engineer, in writing using department form WS4567, that all steel, iron, and coating processes for steel or iron incorporated into the contract work conform to these "Buy America" provisions. Attach a list of exemptions and their associated costs to the certification form. Department form WS4567 is available at:

<http://wisconsindot.gov/rdwy/worksheets/ws4567.doc>

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 HIGHWAYS AND TRANSPORTATION FACILITIES**

SUPPLEMENTAL REQUIRED CONTRACT PROVISIONS

- I. Wage Rates, Hours of labor and payment of Wages
- II. Payroll Requirements
- III. Postings at the Site of the Work
- IV. Affidavits
- V. Wage Rate Redistribution
- VI. Additional Classifications

I. WAGE RATES, HOURS OF LABOR AND PAYMENT OF WAGES

The schedule of "Minimum Wage Rates" attached hereto and made a part hereof furnishes the prevailing wage rates that have been determined pursuant to Section 103.50 of the Wisconsin Statutes. These wage rates are the minimum required to be paid to the various laborers, workers, mechanics and truck drivers employed by contractors and subcontractors on the construction work embraced by the contract and subject to prevailing hours and wages under Section 103.50, Stats. If necessary to employ laborers, workers, mechanics or truck drivers whose classification is not listed on the schedule, they shall be paid at rates conformable to those listed for similar classifications. Apprentices shall be paid at rates not less than those prescribed in their state indenture contracts.

While the wage rates shown are the minimum rates required by the contract to be paid during its life, 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 shall be allowed or authorized on account of the payment of wage rates in excess of those listed herein.

Pursuant to Section 103.50 of the Wisconsin Statutes, the prevailing hours of labor have been determined to be up to 10 hours per day and 40 hours per calendar week Monday through Friday. If any laborer, worker, mechanic or truck driver is permitted or required to work more than the prevailing number of hours per day or per calendar week on this contract, they shall be paid for all hours in excess of the prevailing hours at a rate of at least one and one-half (1 1/2) times their hourly rate of pay. All work on Saturday, Sunday and the following holidays is to be paid at time and a half: (1) January 1, (2) the last Monday in May, (3) July 4, (4) the first Monday in September, (5) the fourth Thursday in November, (6) December 25, (7) the day before if January 1, July 4 or December 25 falls on a Saturday and (8) the day following if January 1, July 4 or December 25 falls on a Sunday.

All laborers, workers, mechanics and truck drivers shall be paid unconditionally not less often than once a week. Persons who own and operate their own trucks must receive the prevailing truck driver rate for the applicable type of truck (i.e. 2 axle, 3 or more axle, articulated, eculid or dumptor) he or she operates, plus an agreed upon amount for the use of his or her truck. Every owner-operator MUST be paid separately for their driving and for the use of their truck.

For those projects subject to the requirements of the Davis-Bacon Act, the Secretary of Labor will also have determined "Minimum Wage Rates" for work to be performed under the contract. These rates are, for all or most of the labor, worker, mechanic or truck driver classifications, identical to those established under Section 103.50 of the Wisconsin Statutes. In the event the rates are not identical, the higher of the two rates will govern.

II. PAYROLL REQUIREMENTS

All contractors and subcontractors must submit weekly Certified Payrolls and Compliance Statement verifying that all laborers, workers, mechanics and truck drivers working on the project have been paid the prevailing wage rates for all work performed under the contract required by Section 103.50 of the Wisconsin Statutes.

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 place at the site of work:

- a. "NOTICE TO EMPLOYEES," which provides information required to be posted by the provisions of Section 103.50 of the Wisconsin Statutes.
- b. A copy of the State of Wisconsin Minimum Wages Rates. (Four pages.)
- c. A copy of the contractor's Equal Employment Opportunity Policy.
- d. On any project involving federal aid, in addition to the furnished postings, the contractor shall post a copy of the "Davis-Bacon Act, Minimum Wage Rates". (Three pages.)

IV. WAGE RATE REDISTRIBUTION

The amount specified as the hourly basic rate of pay and the amount(s) specified as the fringe benefit contribution(s), for all classes of laborers, workers, mechanics or truck drivers may be redistributed, when necessary, to conform to those specified in any applicable collective bargaining agreement, provided that both parties to such agreement

request and receive the approval for any such redistribution from both the Department of Transportation and the Department of Workforce Development prior to the implementation of such redistribution.

V. ADDITIONAL CLASSIFICATIONS

Any unlisted laborer or mechanic classification that is needed to perform work on this project, and is not included within the scope of any of the classifications listed in the application prevailing wage rate determination, may be added after award only if all of the following criteria have been met:

1. The affected employer(s) must make a written request to WisDOT Central Office to utilize the unlisted classification on this project.
2. The request must indicate the scope of the work to be performed by the unlisted classification and must indicate the proposed wage/fringe benefit package that the unlisted classification is to receive.
3. The work to be performed by the unlisted classification must not be performed by a classification that is included in the applicable prevailing wage rate determination.
4. The unlisted classification must be commonly employed in the area where the project is located.
5. The proposed wage/fringe benefit package must bear a reasonable relationship to those set forth in the applicable prevailing wage rate determination.
6. The request should be made prior to the actual performance of the work by the unlisted classification.
7. DWD must approve the use of the unlisted classification and the proposed wage/fringe benefit package. USDOL also must approve the use of the unlisted classification and the proposed wage/fringe benefit package on federal aid projects.
8. WisDOT and DWD may amend the proposed wage/fringe benefit package, as deemed necessary, and may set forth specific employment ratios and scope of work requirements in the approval document.

The approved wage/fringe benefit package shall be paid to all laborers, workers, mechanics or truck drivers performing work within the scope of that performed by the unlisted classification, from the first day on which such work is performed. In the event that work is performed by the unlisted classification prior to approval, the wage/fringe benefit package to be paid for such work must be in conformance with the wage/fringe

benefit package approved for such work. Under this arrangement a retroactive adjustment in wages and/or fringe benefits may be required to be made to the affected laborers, workers, mechanics or truck drivers by the affected employer(s).

**ANNUAL PREVAILING WAGE RATE DETERMINATION
FOR ALL STATE HIGHWAY PROJECTS
LA CROSSE COUNTY**

Compiled by the State of Wisconsin - Department of Workforce Development
for the Department of Transportation
Pursuant to s. 103.50, Stats.
Issued on May 1, 2015

CLASSIFICATION: Contractors are required to call the Department of Workforce Development if there are any questions regarding the proper trade or classification to be used for any worker on a public works project.

OVERTIME: Time and one-half must be paid for all hours worked over 10 hours per day and 40 hours per calendar week and for all hours worked on Saturday, Sunday and the following six (6) holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; the day before if January 1, July 4 or December 25 falls on a Saturday; the day following if January 1, July 4 or December 25 falls on a Sunday.

FUTURE INCREASE: If indicated for a specific trade or occupation, the full amount of such increase MUST be added to the "TOTAL" indicated for such trade or occupation on the date(s) such increase(s) becomes effective.

PREMIUM PAY: If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whenever such pay is applicable.

SUBJOURNEY: Wage rates may be available for some of the classifications indicated below. Any employer that desires to use any subjourney classification on a project MUST request the applicable wage rate from the Department of Workforce Development PRIOR to the date such classification is used on such project. Form ERD-10880 is available for this purpose and can be obtained by writing to the Department of Workforce Development, Equal Rights Division, P.O. Box 8928, Madison, WI 53708.

<u>TRADE OR OCCUPATION</u>	<u>HOURLY BASIC RATE OF PAY</u>	<u>HOURLY FRINGE BENEFITS</u>	<u>TOTAL</u>
	\$	\$	\$
Bricklayer, Blocklayer or Stonemason	30.28	18.18	48.46
Carpenter	32.72	16.00	48.72
Future Increase(s): Add \$1.42/hr on 6/1/2015; Add \$1.42/hr on 6/1/2016. Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Cement Finisher	33.95	18.01	51.96
Future Increase(s): Add \$1.87 on 6/1/15; Add \$1.75 on 6/1/16. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.			
Electrician	30.59	18.37	48.96
Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Fence Erector	18.50	5.34	23.84
Ironworker	31.50	20.01	51.51
Line Constructor (Electrical)	39.50	19.92	59.42
Painter	26.65	16.09	42.74
Pavement Marking Operator	26.04	20.63	46.67
Piledriver	30.11	26.51	56.62
Future Increase(s): Add \$1.50/hr on 6/1/2015; Add \$1.60/hr on 6/1/2016. Premium Pay: Add \$.65/hr for Piledriver Loftsmen; Add \$.75/hr for Sheet Piling Loftsmen. DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Rofer or Waterproofer	18.40	11.44	29.84
Teledata Technician or Installer	22.25	12.24	34.49

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	\$	\$	\$
Tuckpointer, Caulker or Cleaner	23.60	7.10	30.70
Underwater Diver (Except on Great Lakes)	35.40	15.90	51.30
Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	35.55	15.57	51.12
Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	31.60	14.98	46.58
Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	27.65	13.44	41.09
Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.68	12.83	38.51
Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.63	33.38

TRUCK DRIVERS

Single Axle or Two Axle	25.18	18.31	43.49
Future Increase(s): Add \$1.15/hr on 6/1/2015. Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Three or More Axle	25.28	18.31	43.59
Future Increase(s): Add \$1.15/hr on 6/1/2015. Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Articulated, Euclid, Dumptror, Off Road Material Hauler	30.27	21.15	51.42
Future Increase(s): Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm .			
Pavement Marking Vehicle	23.16	20.01	43.17
Shadow or Pilot Vehicle	24.37	17.77	42.14
Truck Mechanic	24.52	17.77	42.29

LABORERS

General Laborer	30.13	15.14	45.27
Future Increase(s): Add \$1.05/hr eff. 06/01/2015; Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017 Premium Pay: Add \$.10/hr for topman, air tool operator, vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add \$.15/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add \$.20/hr for blaster and powderman; Add \$.25/hr for bottomman; Add \$.35/hr for line and grade specialist; Add \$.45/hr for pipelayer. DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).			
Asbestos Abatement Worker	24.58	14.61	39.19
Landscaper	30.13	15.14	45.27
Future Increase(s): Add \$1.05/hr eff. 06/01/2015; Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017 Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).			

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	\$	\$	\$
Flagperson or Traffic Control Person	26.76	15.14	41.90
Future Increase(s): Add \$1.05/hr eff. 06/01/2015; Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017 Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.			
Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.33	13.65	31.98
Railroad Track Laborer	14.50	3.52	18.02

HEAVY EQUIPMENT OPERATORS

Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Traveling Crane (Bridge Type).	37.72	21.15	58.87
Future Increase(s): Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm .			
Backhoe (Track Type) Having a Mfr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs., & Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver.	37.22	21.15	58.37
Future Increase(s): Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm .			
Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boatmen (NOT Performing Work on the Great Lakes); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor);	36.72	21.15	57.87

<u>TRADE OR OCCUPATION</u>	<u>HOURLY BASIC RATE OF PAY</u>	<u>HOURLY FRINGE BENEFITS</u>	<u>TOTAL</u>
	\$	\$	\$
Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A- Frames. Future Increase(s): Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm .			
Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm .	36.46	21.15	57.61
Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm .	36.17	21.15	57.32
Fiber Optic Cable Equipment.	28.89	17.95	46.84

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin

GENERAL DECISION NUMBER: WI160010

DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

DATE: January 8, 2016

LABORERS CLASSIFICATION:	Basic Hourly Rates	Fringe Benefits		Basic Hourly Rates	Fringe Benefits
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, Utility Man); Batch Truck Dumper; or Cement Handler; Bituminous Worker; (Dumper, Ironer, Smoother, Tamper); Concrete Handler	\$30.67	15.55			
Group 2: Air Tool Operator; Joint Sawyer and Filler (Pavement); Vibrator or Tamper Operator (Mechanical Hand Operated);	30.77	15.55			
Group 3: Bituminous Worker (Raker and Luteman); Formsetter (Curb, Sidewalk, and Pavement); Strike Off man	30.82	15.55			
Group 4: Line and Grade Specialist	31.02	15.55			
Group 5: Blaster and Powderman	30.87	15.55			
Group 6: Flagperson; Traffic Control	27.30	15.55			

Truck Drivers:

1 & 2 Axles	25.18	18.31
Three or More Axles; Euclids, Dumptor & Articulated, Truck Mechanic	25.38	18.31

CLASSES OF LABORER AND MECHANICS

Bricklayer	35.94	17.05
Carpenter	30.48	15.80
Millwright	32.11	15.80
Piledriverman	30.98	15.80
Ironworker	32.85	21.84
Cement Mason/Concrete Finisher	31.37	16.85
Electrician	See Page 3	
Line Construction		
Lineman	42.14	32% + 5.00
Heavy Equipment Operator	40.03	32% + 5.00
Equipment Operator	33.71	32% + 5.00
Heavy Groundman Driver	26.78	14.11
Light Groundman Driver	24.86	13.45
Groundsman	23.18	32% + 5.00
Painters	22.03	12.45
Well Drilling:		
Well Driller	16.52	3.70

Notes: Welders receive rate prescribed for craft performing operation to which welding is incidental. 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 (29 CFR, 5.5(a)(1)(ii)). Includes Modification #0 dated January 8, 2016.

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin

GENERAL DECISION NUMBER: WI160010

DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

DATE: January 8, 2016

<u>POWER EQUIPMENT OPERATORS CLASSIFICATION:</u>	<u>Basic Hourly Rates</u>	<u>Fringe Benefits</u>	<u>POWER EQUIPMENT OPERATORS CLASSIFICATION: (Continued)</u>	<u>Basic Hourly Rates</u>	<u>Fringe Benefits</u>
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	\$38.27	\$21.55	(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 and A-frames; post driver; material hoist operator.	\$37.27	\$21.55
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 jib lengths measuring 175 feet or less, and backhoes (excavators) having a manufacturer's rated capacity of 3 cu. yds. and over, caisson rigs, pile driver, dredge operator, dredge engineer.	\$37.77	\$21.55	Group 4: Greaser, roller steel (5 tons or less); roller (pneumatic tired) - self-propelled; tractor (mounted or towed compactors and light equipment); shouldering machine; self-propelled chip spreader; concrete spreader; finishing machine; mechanical float; curing machine; power subgrader; joint saw (multiple blade) belting machine; burlap machine; texturing machine; tractor, endloader (rubber tired) - light; jeep digger; fork lift; mulcher; launch operator; fireman; environmental burner.	\$37.01	\$21.55
Group 3: Mechanic or welder - heavy duty equipment, cranes with a lifting capacity of 25 tons or less, concrete breaker (manual or remote); vibrator/sonic concrete breaker; concrete laser screed; concrete slipform paver; concrete batch plant operator; concrete pavement spreader - heavy duty (rubber tired); concrete spreader and distributor, automatic subgrader (concrete); concrete grinder and planing machine; concrete slipform curb and gutter machine; slipform concrete placer; tube finisher; hydro blaster (10,000 psi and over); bridge paver; concrete conveyor system; concrete pump; stabilizing mixer (self propelled); shoulder widener; asphalt plant engineer; bituminous paver; bump cutter and grooving machine; milling machine; screed (bituminous paver); asphalt heater, planer and scarifier; backhoes (excavators) having a manufacturers rated capacity of under 3 cu. yds.; grader or motor patrol; tractor			Group 5: Air compressor; power pack; vibratory 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 helper.	\$36.72	\$21.55
			Group 6: Off - road material hauler with or without ejector	\$30.82	\$21.55
			Premium Pay: EPA Level "A" protection - \$3.00 per hour EPA Level "B" protection - \$2.00 per hour EPA Level "C" protection - \$1.00 per hours		

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin

GENERAL DECISION NUMBER: WI160010

DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

DATE: January 8, 2016

LABORERS CLASSIFICATION:		Rates	Benefits		
Electricians				Area 4 -	BROWN, DOOR, KEWAUNEE, MANITOWOC (except Schleswig), MARINETTE (Wausauke and area south thereof), OCONTO, MENOMINEE (East of a line 6 miles West of the West boundary of Oconto County), SHAWANO (except area North of Townships of Aniwa and Hutchins) COUNTIES.
Area 1		\$29.60	26.5%+ 9.15		
Area 2:				Area 5 -	ADAMS, CLARK (Colby, Freemont, Lynn, Mayville, Sherman, Sherwood, Unity), FOREST, JUNEAU, LANGLADE, LINCOLN, MARATHON, MARINETTE (Area North of the town of Wausauke), MENOMINEE (Area West of a line 6 miles West of the West boundary of Oconto County), ONEIDA, PORTAGE, SHAWANO (Area North of the townships of Aniwa and Hutchins), VILAS AND WOOD COUNTIES
Electricians.....		31.21	18.92		
Area 3:				Area 6 -	KENOSHA COUNTY
Electrical contracts under \$130,000		28.96	18.26	Area 8 -	DODGE, (Emmet Township only), GREEN, JEFFERSON, LAFAYETTE, RACINE (Burlington township), ROCK and WALWORTH COUNTIES
Electrical contracts over \$130,000		31.16	18.34	Area 9 -	COLUMBIA, DANE, DODGE, (area west of Hwy. 26, except Chester & 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
Area 4:		29.84	29.50% + 9.37	Area 10 -	CALUMET (Township of New Holstein), DODGE (East of Hwy. 26 including Chester Township), FOND DU LAC, MANITOWOC (Schleswig), and SHEBOYGAN COUNTIES
Area 5		28.96	24.85% + 9.70	Area 11 -	DOUGLAS COUNTY
Area 6		35.25	19.30	Area 12 -	RACINE (except Burlington township) COUNTY
Area 8				Area 13 -	MILWAUKEE, OZAUKEE, WASHINGTON and WAUKESHA COUNTIES
Electricians.....		31.90	24.95% + 10.46	Area 14 -	Statewide.
Area 9:				Area 15 -	DODGE (East of Hwy 26 including Chester Twp, excluding Emmet Twp), FOND DU LAC (Except Waupun), MILWAUKEE, OZAUKEE, MANITOWOC (Schleswig), WASHINGTON, AND WAUKESHA COUNTIES.
Electricians.....		35.75	19.87		
Area 10		29.64	20.54		
Area 11		32.54	24.07		
Area 12		34.98	19.89		
Area 13		35.13	23.09		
Teledata System Installer					
Area 14					
Installer/Technician		22.50	12.72		
Sound & Communications					
Area 15					
Installer		16.47	14.84		
Technician		26.00	17.70		
Area 1 -	CALUMET (except township of New Holstein), GREEN LAKE (N. part, including Townships of Berlin, St. Marie and Seneca), MARQUETTE (N. part, including Townships of Crystal Lake, Neshkoro, Newton & Springfield), OUTAGAMIE, WAUPACA, WAUSHARA and WINNEBAGO COUNTIES.				
Area 2 -	ASHLAND, BARRON, BAYFIELD, BUFFALO, BURNETT, CHIPPEWA, CLARK (except Mayville, Colby, Unity, Sherman, Fremont, Lynn and 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				
Area 3 -	FLORENCE (townships of Aurora, Commonwealth, Fern, Florence and Homestead), MARINETTE (Niagara township)				

General Decision Number: WI160003 01/08/2016 WI3

Superseded General Decision Number: WI20150003

State: Wisconsin

Construction Type: Building

County: La Crosse County in Wisconsin.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.15 for calendar year 2016 applies to all contracts subject to the Davis-Bacon Act for which the solicitation was issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.15 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2016. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/08/2016

ASBE0205-001 06/01/2001

	Rates	Fringes
Asbestos Removal worker/hazardous material handler		
Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not.....	\$ 17.90	4.45

BOIL0107-001 01/01/2015

	Rates	Fringes
BOILERMAKER		
Boilermaker.....	\$ 33.35	28.60
Small Boiler Repair (under 25,000 lbs/hr).....	\$ 26.91	16.00

* BRWI0001-004 06/01/2015

	Rates	Fringes
Bricklayer & Tile Setter.....	\$ 31.22	16.69

CARP0252-001 07/02/2012

	Rates	Fringes
CARPENTER (Including Drywall Hanging, Acoustical work, Excluding Batt Insulation)		
CARPENTER & SOFT FLOOR LAYER.....	\$ 30.48	15.80
MILLWRIGHT.....	\$ 32.11	15.80
PILEDRIVERMAN.....	\$ 30.98	15.80

ELEC0014-004 06/01/2015

	Rates	Fringes
ELECTRICIAN.....	\$ 31.21	18.92

ELEC0014-005 06/01/2014

	Rates	Fringes
Teledata System Installer Installer/Technician.....	\$ 22.50	12.72

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).

ELEV0132-001 01/01/2015

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 46.83	28.385

FOOTNOTE:
PAID VACATION: Employer contributes 8% of basic hourly rate as vacation pay for employees with more than 5 years or more of service, and 6% for less than 5 years of service.
PAID HOLIDAYS: New Years Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

ENGI0139-002 06/01/2015

	Rates	Fringes
OPERATOR: Power Equipment		
Group 1.....	\$ 37.67	20.10
Group 2.....	\$ 36.42	20.10

Group 3.....	\$ 35.22	20.10
Group 4.....	\$ 34.69	20.10
Group 5.....	\$ 32.62	20.10
Group 6.....	\$ 31.99	20.10

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; Cranes, Tower Cranes, and Derricks with boom, leads and/or jib lengths 176 ft or longer.

GROUP 2: Backhoes (Excavators) weighing 130,000 lbs & over; Cranes, Tower Cranes and Derricks with or without attachments with a lifting capacity of 100 tons or less; Cranes, Tower Cranes, and Derricks with boom, leads, and/or jib lengths 175 ft or less; Caisson Rigs; Pile Driver

GROUP 3: Backhoes (Excavators) weighing under 130,000 lbs; Travelling Crane (bridge type); Milling Machine; Concrete Paver over 27 E; Concrete Spreader and Distributor; Concrete Laser Screed; Concrete Grinder and Planing Machine; Slipform Curb and Gutter Machine; Boring Machine (Directional); Dredge Operator; Skid Rigs; Over 46 meter Concrete Pump.

GROUP 4: Hydraulic Backhoe (tractor or truck mounted); Hydraulic Crane, 10 tons or less; Tractor, Bulldozer, or End Loader (over 40 hp); Motor Patrol; Scraper Operator; Bituminous Plant and Paver Operator; Screed-Milling Machine; Roller over 5 tons; Concrete Pumps 46 meter & under; Grout Pumps; Rotec Type Machine; Hydro Blaster, 10,000 psi and over; Rotary Drill Operator; Percussion Drilling Machine; Air Track Drill with or without integral hammer; Blaster; Boring Machine (vertical or horizontal); Side Boom; Trencher, wheel type or chain type having 8 inch or larger bucket; Rail Leveling Machine (Railroad); Tie Placer; Tie Extractor; Tie Tamper; Stone Leveler; Straddle Carrier; Material Hoists; Stack Hoist; Man Hoists; Mechanic and Welder; Off Road Material Haulers

GROUP 5: Tractor, Bulldozer, or Endloader (under 40 hp); Tampers -Compactors, riding type; Stump Chipper, large; Roller, Rubber Tire; Backfiller; Trencher, chain type (bucket under 8 inch); Concrete Auto Breaker, large; Concrete Finishing Machine (road type); Concrete Batch Hopper; Concrete Conveyor Systems; Concrete Mixers, 14S or over; Pumps, Screw Type and Gypsum; Hydrohammers, small; Brooms and Sweepers; Lift Slab Machine; Roller under 5 tons; Industrial Locomotives; Fireman (Pile Drivers and Derricks); Pumps (well points); Hoists, automatic; A-Frames and Winch Trucks; Hoists (tuggers); Boats (Tug, Safety, Work Barges and Launches); Assistant Engineer

GROUP 6: Shouldering Machine Operator; Farm or Industrial

Tractor mounted equipment; Post Hole Digger; Auger (vertical and horizontal); Skid Steer Loader with or without attachments; Robotic Tool Carrier with or without attachments; Power Pack Vibratory/Ultra Sound Driver and Extractor; Fireman (Asphalt Plants); Screed Operator; Stone Crushers and Screening Plants; Air, Electric, Hydraulic Jacks (Slip Form); Prestress Machines; Air Compressor, 400 CFM or over; Refrigeration Plant/Freeze Machine; Boiler Operators (temporary heat); Forklifts; Welding Machines; Generators; Pumps over 3"; Compressors, under 400 CFM; Heaters, Mechanical; Combination small equipment operator; Winches, small electric; Oiler; Greaser; Rotary Drill Tender; Conveyor; Elevator Operator

IRON0383-002 06/01/2015

	Rates	Fringes
IRONWORKER.....	\$ 32.85	21.84

LABO0140-001 06/01/2015

	Rates	Fringes
Laborer, General.....	\$ 25.81	15.55
Laborer: Asbestos/hazardous material remover (Preparation, Removal and Encapsulation of Hazardous Materials from Non-Mechanical Systems).....	\$ 24.92	15.55

NOTE: Mason Tender \$.25 over general laborer scale; Pipelayer \$1.00 over general laborer scale

PAIN0259-005 05/01/2015

	Rates	Fringes
PAINTER.....	\$ 22.03	12.45

PLAS0599-006 07/01/2012

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 25.85	18.10
PLASTERER.....	\$ 31.56	18.18

PLUM0434-001 05/31/2015

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work).....	\$ 36.75	16.32

SFWI0669-002 04/01/2015

	Rates	Fringes

SPRINKLER FITTER.....	\$ 38.28	18.61

 SHEE0018-008 06/01/2015

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Work and Technicians).....	\$ 28.75	21.62

 TEAM0662-003 05/01/2010

	Rates	Fringes
TRUCK DRIVER		
1 & 2 Axles.....	\$ 25.09	15.20
3 or more Axles.....	\$ 25.24	15.20

 SUWI2002-004 01/23/2002

	Rates	Fringes
Asbestos Worker/Heat and Frost Insulator.....	\$ 25.36	8.37
Laborers:		
Concrete Workers.....	\$ 16.34	3.59
Landscape.....	\$ 8.73	4.90
ROOFER.....	\$ 18.01	3.28
Tile & Marble Finisher.....	\$ 13.89	8.33

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

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

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

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

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

Survey Rate Identifiers

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

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

Union Average Rate Identifiers

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

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

WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

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

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

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

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

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

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

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

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END OF GENERAL DECISION

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State of Wisconsin Department of Workforce Development Equal Rights Division	DEPARTMENTAL ORDER
ISSUE DATE: 1/26/2016	
PROJECT:	
LA CROSSE - SPARTA SAFET REST AREA NO. 31 CAMPBELL TOWN, LA CROSSE COUNTY, WI Determination No. 201600275 [Owner Project No. 1070-00-71]	
PROJECT OWNER:	REQUESTER:
ROBERT SPOERL, ROADSIDE FACILITIES ENGINEER DEPARTMENT OF TRANSPORTATION 4802 SHEBOYGAN AVE. 501 MADISON, WI 53705	JOSHUA C. TARBELL, PROFESSIONAL ENGINEER SEH 717 THIRD AVENUE SE ROCHSTER, MN 55904
ADDITIONAL CONTACT:	NOTE: The Requester must provide a copy of this Project Determination and enclosures to the Project Owner and Additional Contact.
The department received an application for prevailing wage rate determination for the above-captioned project. The department conducted a survey to determine the prevailing wage rate for the trade(s) or occupation(s) needed to complete the project. The survey's findings appear in the attached project determination. If you believe that the wage rate for any trade or occupation does not accurately reflect the prevailing wage rate in the city, village or town where the project is located, you may ask the department to conduct an administrative review of such wage rate. You must submit this request in writing within 30 days from the date indicated above. Additionally, your request must include wage rate information from at least three similar projects in the city, village or town where the proposed project is located and on which some work has been performed by the contested trade(s) during the current survey period and was previously considered by the department in issuing the attached determination. See DWD 290.10 of the Wisconsin Administrative Code and either s. 66.0903(3)(br), Stats., or s. 103.49(3)(c), Stats., for a complete explanation of the administrative review process. Enclosures	
It is hereby ordered that the prevailing wage rates set forth in the attached project determination shall only be applicable to the above referenced project. This order is a FINAL ORDER of the department unless a timely request for an administrative review is filed with the department. ISSUED BY: Equal Rights Division Labor Standards Bureau Construction Wage Standards Section P.O. Box 8928, Madison, WI 53708-8928 (608)266-6861 Web Site: http://dwd.wisconsin.gov/er/	

PREVAILING WAGE RATE DETERMINATION

Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 103.49, Wis. Stats.
Issued On: 1/26/2016

DETERMINATION NUMBER: 201600275

EXPIRATION DATE: Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2016. If NOT, You MUST Reapply.

PROJECT NAME: LA CROSSE - SPARTA SAFET REST AREA NO. 31
PROJECT NO: 1070-00-71

PROJECT LOCATION: CAMPBELL TOWN, LA CROSSE COUNTY, WI

CONTRACTING AGENCY: DEPARTMENT OF TRANSPORTATION

CLASSIFICATION:	Contractors are responsible for correctly classifying their workers. Either call the Department of Workforce Development (DWD) with trade or classification questions or consult DWD's Dictionary of Occupational Classifications & Work Descriptions on the DWD website at: dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm .
OVERTIME:	Time and one-half must be paid for all hours worked: - over 10 hours per day on prevailing wage projects - over 40 hours per calendar week - Saturday and Sunday - on all of the following holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; - The day before if January 1, July 4 or December 25 falls on a Saturday; - The day following if January 1, July 4 or December 25 falls on a Sunday. Apply the time and one-half overtime calculation to whichever is higher between the Hourly Basic Rate listed on this project determination or the employee's regular hourly rate of pay. Add any applicable Premium or DOT Premium to the Hourly Basic Rate before calculating overtime. A DOT Premium (discussed below) may supersede this time and one-half requirement.
FUTURE INCREASE:	When a specific trade or occupation requires a future increase, you MUST add the full hourly increase to the "TOTAL" on the effective date(s) indicated for the specific trade or occupation.
PREMIUM PAY:	If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whenever such pay is applicable.
DOT PREMIUM:	This premium only applies to highway and bridge projects owned by the Wisconsin Department of Transportation and to the project type heading "Airport Pavement or State Highway Construction." DO NOT apply the premium calculation under any other project type on this determination.
APPRENTICES:	Pay apprentices a percentage of the applicable journey person's hourly basic rate of pay and hourly fringe benefit contributions specified in this determination. Obtain the appropriate percentage from each apprentice's contract or indenture.
SUBJOURNEY:	Subjourney wage rates may be available for some of the trades or occupations indicated below with the exception of laborers, truck drivers and heavy equipment operators. Any employer interested in using a subjourney classification on this project MUST complete Form ERD-10880 and request the applicable wage rate from the Department of Workforce Development PRIOR to using the subjourney worker on this project.

This document **MUST BE POSTED** by the **CONTRACTING AGENCY** in at least one conspicuous and easily accessible place **on the site of the project**. A local governmental unit may post this document at the place normally used to post public notices if there is no common site on the project. This document **MUST** remain posted during the entire time any worker is employed on the project and **MUST** be physically incorporated into the specifications and all contracts and subcontracts. If you have any questions, please write to the Equal Rights Division, Labor Standards Bureau, P.O. Box 8928, Madison, Wisconsin 53708 or call (608) 266-6861.

The following statutory provisions apply to state agency projects of public works and are set forth below pursuant to the requirements of s. 103.49(3)(a), Stats.

s. 103.49 (1) (c) "PREVAILING HOURS OF LABOR" for any trade or occupation in any area means 10 hours per day and 40 hours per week and may not include any hours worked on a Saturday or Sunday or on any of the following holidays:

1. January 1.
2. The last Monday in May.
3. July 4.
4. The first Monday in September.
5. The 4th Thursday in November.
6. December 25.
7. The day before if January 1, July 4 or December 25 falls on a Saturday.
8. The day following if January 1, July 4 or December 25 falls on a Sunday.

s. 103.49 (2) PREVAILING WAGE RATES AND HOURS OF LABOR.

Any contract made for the erection, construction, remodeling, repairing, or demolition of any project of public works to which the state or any state agency is a party shall contain a stipulation that no person performing the work described in sub. (2m) may be permitted to work a greater number of hours per day or per week than the prevailing hours of labor, except that any such person may be permitted or required to work more than such prevailing hours of labor per day and per week if he or she is paid for all hours worked in excess of the prevailing hours of labor at a rate of at least 1.5 times his or her hourly basic rate of pay; nor may he or she be paid less than the prevailing wage rate determined under sub. (3) in the same or most similar trade or occupation in the area in which the project of public works is situated. A reference to the prevailing wage rates determined under sub. (3) and the prevailing hours of labor shall be published in the notice issued for the purpose of securing bids for the project. If any contract or subcontract for a project of public works that is subject to this section is entered into, the prevailing wage rates determined under sub. (3) and the prevailing hours of labor shall be physically incorporated into and made a part of the contract or subcontract, except that for a minor subcontract, as determined by the department, the department shall prescribe by rule the method of notifying the minor subcontractor of the prevailing wage rates and prevailing hours of labor applicable to the minor subcontract. The prevailing wage rates and prevailing hours of labor applicable to a contract or subcontract may not be changed during the time that the contract or subcontract is in force.

s. 103.49 (6M) LIABILITY AND PENALTIES.

- (ag) 1. Any contractor, subcontractor, or contractor's or subcontractor's agent who fails to pay the prevailing wage rate determined by the department under sub. (3) or who pays less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor is liable to any affected employee in the amount of his or her unpaid wages or his or her unpaid overtime compensation and in an additional amount as liquidated damages as provided in subd. 2., 3., whichever is applicable.
2. If the department determines upon inspection under sub. (5) (b) or (c) that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the department shall order the contractor to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages within a period specified by the department in the order.
3. In addition to or in lieu of recovering the liability specified in subd. 1. as provided in subd. 2., any employee for and in behalf of that employee and other employees similarly situated may commence an action to recover that liability in any court of competent jurisdiction. If the court finds that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the court shall order the contractor, subcontractor, or agent to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages.

(am) Except as provided in pars. (b), (d) and (f), any contractor, subcontractor or contractor's or subcontractor's agent who violates this section may be fined not more than \$200 or imprisoned for not more than 6 months or both. Each day that a violation continues is a separate offense.

(b) Whoever induces any person who seeks to be or is employed on any project of public works that is subject to this section to give up, waive, or return any part of the wages to which the person is entitled under the contract governing the project, or who reduces the hourly basic rate of pay normally paid to a person for work on a project that is not subject to this section during a week in which the person works both on a project of public works that is subject to this section and on a project that is not subject to this section, by threat not to employ, by threat of dismissal from employment, or by any other means is guilty of an offense under s. 946.15 (1).

(c) Any person employed on a project of public works that is subject to this section who knowingly permits a contractor, subcontractor, or contractor's or subcontractor's agent to pay him or her less than the prevailing wage rate set forth in the contract governing the project, who gives up, waives, or returns any part of the compensation to which he or she is entitled under the contract, or who gives up, waives, or returns any part of the compensation to which he or she is normally entitled for work on a project that is not subject to this section during a week in which the person works both on a project of public works that is subject to this section and on a project that is not subject to this section, is guilty of an offense under s. 946.15 (2).

(d) Whoever induces any person who seeks to be or is employed on any project of public works that is subject to this section to permit any part of the wages to which the person is entitled under the contract governing the project to be deducted from the person's pay is guilty of an offense under s. 946.15 (3), unless the deduction would be permitted under 29 CFR 3.5 or 3.6 from a person who is working on a project that is subject to 40 USC 3142.

(e) Any person employed on a project of public works that is subject to this section who knowingly permits any part of the wages to which he or she is entitled under the contract governing the project to be deducted from his or her pay is guilty of an offense under s. 946.15 (4), unless the deduction would be permitted under 29 CFR 3.5 or 3.6 from a person who is working on a project that is subject to 40 USC 3142.

5. No employee may be a party plaintiff to an action under subd. 3. unless the employee consents in writing to become a party and the consent is filed in the court in which the action is brought. Notwithstanding s. 814.04 (1), the court shall, in addition to any judgment awarded to the plaintiff, allow reasonable attorney fees and costs to be paid by the defendant.

BUILDING OR HEAVY CONSTRUCTION

Includes sheltered enclosures with walk-in access for the purpose of housing persons, employees, machinery, equipment or supplies and non-sheltered work such as canals, dams, dikes, reservoirs, storage tanks, etc. A sheltered enclosure need not be "habitable" in order to be considered a building. The installation of machinery and/or equipment, both above and below grade level, does not change a project's character as a building. On-site grading, utility work and landscaping are included within this definition. Residential buildings of four (4) stories or less, agricultural buildings, parking lots and driveways are NOT included within this definition.

SKILLED TRADES

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
101	Acoustic Ceiling Tile Installer	41.31	15.65	56.96
102	Boilermaker	33.35	28.04	61.39
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add \$1.45 on 06/06/2016 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	31.22	19.98	51.20
104	Cabinet Installer Future Increase(s): Add \$1.42/hr on 6/1/2016.	33.02	17.12	50.14
105	Carpenter Future Increase(s): Add \$1.42/hr on 6/1/2016. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.02	17.12	50.14
106	Carpet Layer or Soft Floor Coverer Future Increase(s): Add \$1.42/hr on 6/1/2016.	33.02	17.12	50.14
107	Cement Finisher Future Increase(s): Add \$1.50 on 05/30/2016;	27.36	20.44	47.80
108	Drywall Taper or Finisher	19.00	2.21	21.21
109	Electrician Future Increase(s): Add \$1.15 on 6/1/16 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	31.21	18.96	50.17
110	Elevator Constructor	46.05	27.09	73.14
111	Fence Erector	19.27	7.35	26.62

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
112	Fire Sprinkler Fitter	38.28	18.81	57.09
113	Glazier	31.38	8.32	39.70
114	Heat or Frost Insulator	33.53	27.32	60.85
115	Insulator (Batt or Blown)	23.62	11.55	35.17
116	Ironworker	32.50	20.58	53.08
117	Lather	32.72	16.00	48.72
118	Line Constructor (Electrical)	38.59	27.20	65.79
119	Marble Finisher	25.72	18.54	44.26
120	Marble Mason	30.98	18.83	49.81
121	Metal Building Erector	19.77	0.00	19.77
122	Millwright	34.44	16.05	50.49
123	Overhead Door Installer	21.99	3.40	25.39
124	Painter	32.88	14.80	47.68
125	Pavement Marking Operator	30.00	18.81	48.81
126	Piledriver Future Increase(s): Add \$1.44/hr on 6/1/2016. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.56	17.12	50.68
127	Pipeline Fuser or Welder (Gas or Utility)	35.55	16.12	51.67
129	Plasterer Future Increase(s): Add \$1.40 on 06/01/2016; Add \$1.50 on 06/01/2017 Premium Increase(s): Add \$.25/hr. for work on swing scaffolds.	30.43	18.77	49.20
130	Plumber	36.75	16.32	53.07
132	Refrigeration Mechanic	36.75	16.32	53.07
133	Roofer or Waterproofer	20.82	10.48	31.30
134	Sheet Metal Worker	28.41	20.74	49.15
135	Steamfitter	36.75	16.32	53.07
137	Teledata Technician or Installer	17.50	5.57	23.07
138	Temperature Control Installer	19.58	2.27	21.85
139	Terrazzo Finisher	25.72	18.54	44.26

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
140	Terrazzo Mechanic Future Increase(s): Add \$1.45 on 06/06/2016	31.59	19.60	51.19
141	Tile Finisher	30.00	0.00	30.00
142	Tile Setter Future Increase(s): Add \$1.45/hr on 6/06/2016.	31.22	19.98	51.20
143	Tuckpointer, Caulker or Cleaner Future Increase(s): Add \$1.45 on 06/06/2016 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	31.36	19.84	51.20
144	Underwater Diver (Except on Great Lakes)	36.74	16.00	52.74
146	Well Driller or Pump Installer Future Increase(s): Add \$1/hr on 6/1/2016; Add \$1/hr on 6/1/2017.	25.32	16.40	41.72
147	Siding Installer	17.00	6.71	23.71
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	39.57	24.46	64.03
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	32.65	15.52	48.17
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	28.57	13.71	42.28
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.53	13.55	40.08
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	25.00	12.55	37.55
TRUCK DRIVERS				

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
201	Single Axle or Two Axle Future Increase(s): Add \$1.15/hr on 6/1/2015. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	25.68	18.96	44.64
203	Three or More Axle	17.00	2.64	19.64
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add \$1.60/hr on 6/3/2016.	34.69	20.38	55.07

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
205	Pavement Marking Vehicle	17.00	2.64	19.64
207	Truck Mechanic	17.00	2.64	19.64

LABORERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
301	General Laborer Future Increase(s): Add \$1.25/hr eff. 06/06/2016 Premium Increase(s): Add \$1.00/hr for certified welder and pipelayer; Add \$.25/hr for mason tender.	25.81	15.63	41.44
302	Asbestos Abatement Worker	25.02	15.63	40.65
303	Landscaper	18.00	3.04	21.04
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	21.14	14.65	35.79
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	15.50	0.79	16.29
314	Railroad Track Laborer	17.50	2.18	19.68
315	Final Construction Clean-Up Worker	29.01	17.39	46.40

**HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
501	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Milling Machine; Boring Machine (Directional, Horizontal or Vertical); Backhoe (Track Type) Having a Mfg's Rated Capacity of 130,000 Lbs. or Over; Backhoe (Track Type) Having a Mfg's Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Crane, Shovel, Dragline, Clamshells; Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Grader or Motor Patrol; Master Mechanic; Mechanic or Welder; Robotic Tool Carrier (With or Without Attachments); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Tractor (Scraper, Dozer, Pusher, Loader); Trencher (Wheel Type or Chain Type Having Over 8 Inch Bucket). Future Increase(s): Add \$1.60/hr on 6/3/2016.	35.22	20.38	55.60

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
502	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Environmental Burner; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Jeep Digger; Screed (Milling Machine); Skid Rig; Straddle Carrier or Travel Lift; Stump Chipper; Trencher (Wheel Type or Chain Type Having 8 Inch Bucket & Under). Future Increase(s): Add \$1.60/hr on 6/3/2016.	34.69	20.38	55.07
503	Air Compressor (&/or 400 CFM or Over); Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Greaser; High Pressure Utility Locating Machine (Daylighting Machine); Mulcher; Oiler; Post Hole Digger or Driver; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.60/hr on 6/3/2016.	34.69	20.38	55.07
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	41.65	21.71	63.36
505	Work Performed on the Great Lakes Including Crane or Backhoe Operator; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder; 70 Ton & Over Tug Operator. Future Increase(s): Add \$1.25/hr on 1/1/2017. Premium Increase(s): Add \$.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	44.05	23.24	67.29
506	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery. Future Increase(s): Add \$1.25/hr on 1/1/2017.	39.20	23.09	62.29
507	Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	36.72	21.15	57.87

**HEAVY EQUIPMENT OPERATORS
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
508	Boring Machine (Directional); Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Future Increase(s): Add \$1.60/hr on 6/3/2016. Premium Increase(s): Add \$.50/hr for >200 Ton; Add \$1/hr at 300 Ton; Add \$1.50/hr at 400 Ton; Add \$2/hr at 500 Ton & Over.	37.67	20.38	58.05
509	Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Boring Machine (Horizontal or Vertical); Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Pile Driver; Versi Lifts, Tri-Lifts & Gantrys (20,000 Lbs. & Over). Future Increase(s): Add \$1.60/hr on 6/3/2016. Premium Increase(s): Add \$.25/hr for all >45 Ton lifting capacity cranes.	36.42	20.38	56.80
510	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Dredge (NOT Performing Work on the Great Lakes); Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Hydro-Blaster (10,000 PSI or Over); Milling Machine; Skid Rig; Traveling Crane (Bridge Type). Future Increase(s): Add \$1.60/hr on 6/3/2016.	35.22	20.38	55.60

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
511	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Environmental Burner; Gantrys (Under 20,000 Lbs.); Grader or Motor Patrol; High Pressure Utility Locating Machine (Daylighting Machine); Manhoist; Material or Stack Hoist; Mechanic or Welder; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tining or Curing Machine; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).	33.69	10.51	44.20
512	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Grout Pump; Hoist (Tugger, Automatic); Industrial Locomotives; Jeep Digger; Lift Slab Machine; Mulcher; Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames. Future Increase(s): Add \$1.60/hr on 6/3/2016.	32.62	20.38	53.00
513	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Boatmen (NOT Performing Work on the Great Lakes); Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Elevator; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Forklift; Generator (&/or 150 KW or Over); Greaser; Heaters (Mechanical); Loading Machine (Conveyor); Oiler; Post Hole Digger or Driver; Prestress Machine; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.60/hr on 6/3/2016.	31.99	20.38	52.37
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment). Future Increase(s): Add \$1/hr on 5/30/2016.	37.04	22.44	59.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment).	34.76	20.30	55.06
516	Fiber Optic Cable Equipment	18.00	0.00	18.00

SEWER, WATER OR TUNNEL CONSTRUCTION

Includes those projects that primarily involve public sewer or water distribution, transmission or collection systems and related tunnel work (excluding buildings).

SKILLED TRADES

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
103	Bricklayer, Blocklayer or Stonemason	30.98	18.83	49.81
105	Carpenter	32.72	16.00	48.72
107	Cement Finisher Future Increase(s): Add \$1.75 on 6/1/16. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	35.97	17.85	53.82
109	Electrician Future Increase(s): Add \$1.60 on 6/1/16; Add \$1.70 on 6/1/17 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	35.13	23.19	58.32
111	Fence Erector	19.27	7.35	26.62
116	Ironworker	32.50	20.58	53.08
118	Line Constructor (Electrical)	38.59	27.20	65.79
125	Pavement Marking Operator	30.00	18.81	48.81
126	Piledriver	33.24	16.00	49.24
130	Plumber Future Increase(s): Add \$1.50 on 6/1/16	39.95	19.45	59.40
135	Steamfitter	35.55	16.12	51.67
137	Teledata Technician or Installer	17.50	5.57	23.07
143	Tuckpointer, Caulker or Cleaner	31.12	18.69	49.81
144	Underwater Diver (Except on Great Lakes)	31.00	20.43	51.43
146	Well Driller or Pump Installer Future Increase(s): Add \$1/hr on 6/1/2016; Add \$1/hr on 6/1/2017.	25.32	16.40	41.72

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	36.73	15.92	52.65
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	32.65	15.52	48.17
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	28.57	13.71	42.28
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.53	13.55	40.08
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.97	34.72

TRUCK DRIVERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
201	Single Axle or Two Axle	19.00	0.00	19.00
203	Three or More Axle	19.00	0.00	19.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	33.69	19.78	53.47
205	Pavement Marking Vehicle	19.00	0.00	19.00
207	Truck Mechanic	19.00	0.00	19.00

LABORERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
301	General Laborer Future Increase(s): Add \$1.25/hr eff. 06/06/2016 Premium Increase(s): Add \$.20 for blaster, bracer, manhole builder, caulker, bottomman and power tool; Add \$.55 for pipelayer; Add \$1.00 for 0-15 lbs. compressed air; Add \$2.00 for 15-30 lbs. compressed air; Add \$3.00 for over 30 lbs. compressed air.	26.93	15.64	42.57
303	Landscaper	41.00	0.00	41.00
304	Flagperson or Traffic Control Person	26.76	15.14	41.90
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	15.50	0.79	16.29
314	Railroad Track Laborer	17.50	2.18	19.68

**HEAVY EQUIPMENT OPERATORS
SEWER, WATER OR TUNNEL WORK**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
521	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Master Mechanic; Pile Driver. Premium Increase(s): Add \$.25/hr for operating tower crane.	38.09	20.80	58.89
522	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Spreader & Distributor; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Dredge (NOT Performing Work on the Great Lakes); Milling Machine; Skid Rig; Telehandler; Traveling Crane (Bridge Type). Future Increase(s): Add \$1.60/hr on 6/3/2016.	35.22	20.38	55.60
523	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Boring Machine (Horizontal or Vertical); Bulldozer or Endloader (Over 40 hp); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Manhoist; Material or Stack Hoist; Mechanic or Welder; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket). Premium Increase(s): Add \$.25/hr for operating tower crane.	36.36	20.80	57.16

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
524	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Environmental Burner; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Hoist (Tugger, Automatic); Grout Pump; Jeep Digger; Lift Slab Machine; Mulcher; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Tining or Curing Machine; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames.	33.69	21.75	55.44
525	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Loading Machine (Conveyor); Post Hole Digger or Driver; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	30.19	22.06	52.25
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	30.99	19.78	50.77
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	41.65	21.71	63.36
528	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	41.65	21.71	63.36
529	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	36.72	21.15	57.87
530	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under), Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	36.72	21.15	57.87

LOCAL STREET OR MISCELLANEOUS PAVING CONSTRUCTION

Includes roads, streets, alleys, trails, bridges, paths, racetracks, parking lots and driveways (except residential or agricultural), public sidewalks or other similar projects (excluding projects awarded by the Wisconsin Department of Transportation).

SKILLED TRADES

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked				
CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY \$	HOURLY FRINGE BENEFITS \$	TOTAL \$
103	Bricklayer, Blocklayer or Stonemason	30.98	18.83	49.81
105	Carpenter Future Increase(s): Add \$1.42/hr on 6/1/2016. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.02	17.12	50.14
107	Cement Finisher Future Increase(s): Add \$1.50 on 05/30/2016;	27.36	20.44	47.80
109	Electrician	34.82	20.04	54.86
111	Fence Erector	19.27	7.35	26.62
116	Ironworker	32.50	20.58	53.08
118	Line Constructor (Electrical)	38.59	27.20	65.79
124	Painter	32.88	14.80	47.68
125	Pavement Marking Operator	30.00	18.81	48.81
126	Piledriver Future Increase(s): Add \$1.44/hr on 6/1/2016. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.56	17.12	50.68
133	Roofer or Waterproofor	20.82	10.48	31.30
137	Teledata Technician or Installer	17.50	5.57	23.07
143	Tuckpointer, Caulker or Cleaner	31.12	18.69	49.81
144	Underwater Diver (Except on Great Lakes)	36.74	16.00	52.74
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	36.73	15.92	52.65
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	32.65	15.52	48.17
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	28.57	13.71	42.28

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.53	13.55	40.08
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.97	34.72

TRUCK DRIVERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
201	Single Axle or Two Axle	19.50	0.20	19.70
203	Three or More Axle	19.50	0.20	19.70
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add \$1.60/hr on 6/3/2016.	34.69	20.38	55.07
205	Pavement Marking Vehicle	19.50	0.20	19.70
206	Shadow or Pilot Vehicle	19.50	0.20	19.70
207	Truck Mechanic	19.50	0.20	19.70

LABORERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
301	General Laborer	28.40	15.14	43.54
303	Landscaper Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017 Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	30.67	15.65	46.32

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
304	Flagperson or Traffic Control Person Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017 Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	27.30	15.65	42.95
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	15.50	0.79	16.29
314	Railroad Track Laborer	17.50	2.18	19.68

**HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
541	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Future Increase(s): Add \$1.60/hr on 6/3/2016. Premium Increase(s): Add \$.50/hr for >200 Ton; Add \$1/hr at 300 Ton; Add \$1.50/hr at 400 Ton; Add \$2/hr at 500 Ton & Over.	37.67	20.38	58.05
542	Backhoe (Track Type) Having a Mfrg.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Crane, Tower Crane Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .	37.77	21.85	59.62

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
543	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx.	37.27	21.85	59.12
544	Backfiller; Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx.	37.27	21.85	59.12

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
545	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.	31.62	19.78	51.40
546	Fiber Optic Cable Equipment.	18.00	0.00	18.00
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	41.65	21.71	63.36
548	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder. Future Increase(s): Add \$1.25/hr on 1/1/2017. Premium Increase(s): Add \$.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	44.05	23.24	67.29
549	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or more); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	36.72	21.15	57.87
550	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	36.72	21.15	57.87

**HEAVY EQUIPMENT OPERATORS
ASPHALT PAVEMENT OR OTHER WORK**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
551	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads and/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.	36.67	19.78	56.45

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
552	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsindot.gov/Page s/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx.	37.77	21.85	59.62
553	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Laser/Screed; Concrete Slipform Placer Curb & Gutter Machine; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames.	36.17	20.85	57.02
554	Backfiller; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self-Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler.	36.17	20.85	57.02

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
555	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.60/hr on 6/3/2016.	32.62	20.38	53.00
556	Fiber Optic Cable Equipment.	18.00	0.00	18.00
***** END OF RATES *****				

The documents following the Prevailing Wage Rate Determination consist of twenty pages (including this one) of various forms/documents that will be used throughout the completion of the project. This prevailing wage rate determination and its underlying legal requirements outlined in the attached documents apply for the life of this project even though work on the project continues into 2017 or beyond. The chart below lists the form number, form/document name, the party who uses the document, and the document's number of pages. If you have any questions regarding these forms please call the Prevailing Wage Office at (608)266-6861.

ERD Form Number	Form Name	Party Who Uses the Form	Pages
	July 2015 description of recent changes to Wisconsin's prevailing wage laws resulting from enactment of the 2015-17 State Budget Bill.		1
	Prevailing Wage - Public Entity Project Owners	Explanation of project owner responsibilities	2
16056	Post the White Sheet	Contracting agency	1
10908	Consolidated List of Debarred Contractors	Any party contracting someone to complete work on a prevailing wage project	4
	Prevailing Wage – Contractors	Explanation of contractor responsibilities	2
7777	Disclosure of Ownership	Contractors that meet the criteria set out in (3)(A)&(B) of the form	1
5724	Prime Contractor Affidavit of Compliance	Prime contractor files with contracting agency upon completion of the work before receiving final payment	2
10584	Agent or Subcontractor Affidavit of Compliance	Subcontractors file with their awarding contractor upon completion of their work on the project before receiving final payment	2
10880	Request to Employ Subjourneyperson	Contractors wishing to employ a subjourneyperson(s)	1
	Additional General Prevailing Wage Law Information	General information for public entity or any other interested party	3

12/22/2015

THE 2015-17 BUDGET BILL MADE SIGNIFICANT CHANGES TO WISCONSIN'S PREVAILING WAGE LAWS. HOWEVER, THOSE CHANGES DO NOT GO INTO EFFECT UNTIL JANUARY 1, 2017.

During calendar year 2016, DWD will continue to enforce prevailing wage laws for local governmental unit and state agency public works projects under current prevailing wage laws.

2015 Wisconsin Act 55 (the budget bill) repealed the state prevailing wage law for **local governmental units** such as villages, towns, cities, school districts, or sewerage districts effective January 1, 2017. However, if a local governmental unit:

- issues a Request for Bids before January 1, 2017, for a project of public works that is subject to bidding or,
- enters into a contract before January 1, 2017, for a project of public works that is not subject to bidding,

then those public works projects are subject to the current prevailing wage law (§66.0903, Wis. Stats.) through the life of the project. Projects of public works with prevailing wage project determinations issued prior to 2017 continue to be subject to the current prevailing wage law through the life of the project even though the project may have work going on in 2017 or subsequent years.

Contractors working on local governmental unit projects with prevailing wage rate determinations must continue to pay employees the appropriate prevailing wage and maintain required prevailing wage payroll records. For instance, if a contractor is working in 2018 on a public works project with a project determination issued prior to 2017, then the contractor is required to comply with the "old" prevailing wage rate law (§66.0903, Wis. Stats.). After January 1, 2017, DWD will continue to enforce prevailing wage requirements for projects with DWD prevailing wage determinations issued under the "old" prevailing wage laws (§§ 66.0903 & 103.49, Wis. Stats.).

For new public works projects starting on January 1, 2017, state prevailing wage law will only apply to **state agency** and **state highway** projects. Prevailing wage rates applicable to state agencies will be those issued by the U.S. Department of Labor under the Davis-Bacon Act, 40 U.S.C. 3142. The Wisconsin Department of Administration will enforce the new state agency prevailing wage law (§16.856, Wis. Stats.) and the Wisconsin Department of Transportation will continue to enforce prevailing wage on state highway projects (under a law renumbered as §84.062, Wis. Stats.).

PREVAILING WAGE – Public Entity Project Owners

Any public works project that has a total estimated project cost that equals or exceeds single-trade or multiple-trade project thresholds requires a prevailing wage rate determination issued by the Department of Workforce Development (DWD). Public works include erecting, constructing, remodeling, repairing, demolishing, alterations, painting and decorating projects for a local governmental unit or state agency. State law excludes minor service or maintenance work, warranty work, or work under a supply-and-installation contract. There is a statutory definition for most of these exclusions. The prevailing wage law that applies to local governmental units is §66.0903, Wis. Stats. The prevailing wage law that applies to state agencies is §103.49, Wis. Stats. The applicable administrative rules for all public entities are DWD 290 and DWD 294, Wis. Adm. Code.

Thresholds

- A "single-trade project of public works" means a project in which a single trade accounts for 85% or more of the total labor cost of the project. The single trade threshold is \$48,000.
- A "multiple-trade project of public works" means a project in which no single trade accounts for 85% or more of the total labor cost of the project.
- (a) The multiple-trade threshold is \$100,000, unless a municipality falls under the description in (b).
 - (b) The multiple-trade threshold of \$234,000 applies to public works projects erected, constructed, repaired, remodeled, or demolished by a private contractor for •a city or village with a population less than 2500 or •a town.

A local governmental unit or state agency that has a public works project that equals or exceeds the prevailing wage thresholds must do all of the following:

- Request a prevailing wage rate determination for the project from DWD at least 30 days before soliciting bids or negotiating contracts. An Application for Prevailing Wage Rate Determination is available on the DWD website: http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm
To avoid waiting for a project determination use the on-line application system that permits the user to generate a determination immediately and save all documents in PDF form to the user's computer. Use this project determination on line application at the following address:

- Tell potential contractors the project is subject to state prevailing wage law when soliciting bids.
- Include the prevailing wage rate determination in the construction contract, or if there is no written contract, provide a copy of the project determination to each prime contractor.
- Award contracts to contractors who do *not* appear on the "Consolidated List of Debarred Contractors."
- Notify contractors that they are required to have a written substance abuse testing program in place that fulfills the requirements of §103.503, Wis. Stats., before commencing work on the prevailing wage project.
- Post the prevailing wage rate determination on the project site. (This document is often referred to as "the white sheet.")
- Notify project contractors that if DWD finds that a contractor violated the prevailing wage law, DWD will assess liquidated damages of 100% of the wages owed to employees.
- Obtain an Affidavit of Compliance from each prime contractor before making final payment for the project.

If the total estimated cost of the project exceeds the prevailing wage thresholds, a local governmental unit or state agency also must obtain a prevailing wage rate determination under the following circumstances:

- when a completed facility is leased, purchased, lease-purchased or otherwise acquired by or dedicated to a public entity in lieu of the public entity contracting for the project,
- when one public entity does work for another public entity,
- when a *private* entity will construct a road, street, bridge, sanitary sewer or water main project and dedicate it to a local governmental unit or the state for its ownership or maintenance (except for some residential subdivisions).

For more information, visit the prevailing wage website: http://dwd.wisconsin.gov/er/prevaling_wage_rate/default.htm. For further assistance, call the Equal Rights Division at 608-266-6861 and ask for prevailing wage.

POST THE WHITE SHEET

As the public entity receiving this prevailing wage rate determination, YOU ARE REQUIRED by law to post the prevailing wage rate determination (i.e., white sheet) in at least one conspicuous and easily accessible place on the project site that is available to all construction workers. The white sheet must remain posted from the onset of the project until all construction labor on the project has been completed.

[See, Wis. Admin. Code §DWD 290.12(1)]

Posting the white sheet inside the general contractor's trailer does not meet this requirement. That placement is not available/accessible to all workers and is not a location over which you have control.

If you have questions about posting, please call (608)266-6861 and ask for prevailing wage intake.

Consolidated List of Debarred Contractors
Prepared and Issued By

January 1, 2016

State of Wisconsin - Department of Workforce Development

This list has been prepared in accordance with the provisions of §§66.0903(12) and 103.49(7), Wis. Stats., and Chapter DWD 294 of the Wisconsin Administrative Code. All contractors on this list were found to have committed a "debarable offense" related to certain labor standard provisions determined or established for a state or local public works project. No state agency, local governmental unit or owner or developer may knowingly solicit bids from, negotiate with or award any contracts to or approve or allow any subcontracts with a debarred contractor, including all divisions, affiliates or other organizational elements of such contractor that are engaged in construction business activities, until the debarment is terminated. The name of each debarred contractor must remain on this list for a period of three (3) years from the termination date indicated below. The contractor is, however, only "debarred" from the "effective date" through the "termination date" indicated for that contractor. Questions regarding this list should be addressed to Jim Chiolino, Equal Rights Division, P. O. Box 8928, Madison, WI 53708 or call (608) 266-3345. Deaf, hearing or speech-impaired callers may contact the department by calling its TDD number (608) 264-8752.

<u>Name of Contractor</u>	<u>Address</u>	<u>Effective Date</u>	<u>Termination Date</u>	<u>Cause Code</u>	<u>Date of Violation(s)</u>	<u>Limitations/Deviations</u>
A-1 Duran Roofing & Insulation Services, Inc.	3700 N Fratney St Milwaukee, WI 53212	11/1/14	10/31/17	1, 2 and 4	2011- 2012	None
	or 8095 NW 64 th St Miami, FL 33166					
Abel, Mike	See, Abel Electric, Inc					
Abel Electric, Inc	3385 Belmar Rd Green Bay, WI 54313	9/1/12	8/31/15	1	2011	None
Alpha Electric, LLC	350 Business Park Dr Sun Prairie, WI 53590	8/1/15	7/31/18	4	2014	None
Arnie Christiansen Mason Contractors, LLC	2304 65 th Dr Franksville, WI 53126	9/1/14	8/31/16	1, 2 and 4	2011	None
Atkins, Scott	See, Freedom Insulation, Inc					
Boecker, Roger	See, R-Way Pumping, Inc					
Brechtel, Mark G	See, Ecodec, Inc					
Cargill Heating and Air Conditioning Company, Inc	3049 Edgewater La La Crosse, WI 54603	3/1/14	2/28/17	1 and 2	2011	None

<u>Name of Contractor</u>	<u>Address</u>	<u>Effective Date</u>	<u>Termination Date</u>	<u>Cause Code</u>	<u>Date of Violation(s)</u>	<u>Limitations/ Deviations</u>
Castlerock Commercial Construction, Inc	PO Box 11699 Milwaukee, WI 53211-0699	2/1/12	1/31/15	1, 2 and 4	2009 & 2010	None
Christiansen, Andy	See, Arnie Christiansen Mason Contractors, LLC					
Christiansen, Arnold	See, Arnie Christiansen Mason Contractors, LLC					
Darnick, Gregory L	See, Darnick Trucking, LLC					
Darnick Trucking, LLC	W914 County Rd V Berlin, WI 54923	11/1/14	10/31/15	1, 2 and 4	2012 & 2013	None
Dem/Ex Group, Inc	805 S Adams St Manito, IL 61546	12/1/11	11/30/14	1 and 2	2010	None
Duran, Bernardo	See, A-1 Duran Roofing & Insulation Services and RRS2 Inc					
Ecodec, Inc	5106 Wintergreen Dr Madison, WI 53704	10/1/14	9/30/17	1	2011 & 2012	None
Fisher, Ed &/or Fisher, Rhonda	See, Dem/Ex Group, Inc					
Freedom Insulation, Inc	117925 219th Ave Chippewa Falls, WI 54729	9/1/11	8/31/14	1	2008- 2010	None
Froode, Kathleen M	See, Masonry Specialists II, LLC					
Galstad, Michael E (aka Michael Earl Galstad)	See, Cargill Heating and Air Conditioning Company, Inc					
Gjolaj, Ded	See, Horizon Bros Painting Corp					

<u>Name of Contractor</u>	<u>Address</u>	<u>Effective Date</u>	<u>Termination Date</u>	<u>Cause Code</u>	<u>Date of Violation(s)</u>	<u>Limitations/ Deviations</u>
Grade A Construction, Inc	157 Enterprise Rd Delafield, WI 53018	1/1/16	12/31/19	1, 2 and 4	2014	None
Horizon Bros Painting Corp	1053 Kendra La Howell, MI 48843	10/1/14	9/30/16	4	2012	None
JT Roofing, Inc	350 Tower Dr Saukville, WI 53080	6/1/12	5/31/15	1, 2 and 4	2007 & 2008	None
Jinkins, Richard	See, Castlerock Commercial Construction, Inc					
John's Concrete	See, Wagner Companies, Inc, dba John's Concrete					
Kott, Joseph J	See, Alpha Electric, LLC					
Masonry Specialists II, LLC	5109 Briarwood Ct Racine, WI 53402	8/1/15	7/31/18	4	2014	None
Mid-W Enterprises, Inc	1730 22 nd Avenue Kenosha, WI 53140	6/1/15	5/31/17	1, 2 and 4	2013	None
Midwest Construction Co, Inc	See, Mid-W Enterprises, Inc					
Oden, Cassie	See, A-1 Duran Roofing & Insulation Services and RRS2 Inc					
Ofstie, Darin	See, Precision Excavating and Grading, LLC					
Peret, Robert	See, A-1 Duran Roofing & Insulation Services and RRS2 Inc					

<u>Name of Contractor</u>	<u>Address</u>	<u>Effective Date</u>	<u>Termination Date</u>	<u>Cause Code</u>	<u>Date of Violation(s)</u>	<u>Limitations/ Deviations</u>
Precision Excavating and Grading, LLC or Precision Excavating Enterprises, LLC	2104 Pierce Saint Croix Rd Baldwin, WI 54002	5/1/11	4/30/14	1, 2 and 4	2006- 2008	None
R-Way Pumping, Inc	3023 Lake Maria Rd Freeport, MN 56331	3/1/12	2/28/15	1, 2 and 4	2008	None
RRS2 Inc.	133 N Jackson St, #427 Milwaukee, WI 53202 or 1313 N Franklin Pl, #805 Milwaukee, WI 53202	11/1/14	10/31/17	1, 2 and 4	2011- 2012	None
Thull, Gerald T	See, JT Roofing, Inc					
Ventura, Robert	See, Mid-W Enterprises, Inc					
Wagner, Cory L	See, Wagner Companies, Inc					
Wagner Companies, Inc, dba John's Concrete	2063 Georgia Ave Racine, WI 53404	8/1/15	7/31/18	1	2013	None
Yares, Kathleen R	See, Grade A Construction, Inc					

Cause Code: 1 = Failure to Pay Straight Time 2 = Failure to Pay Overtime 3 = Kickback 4 = Payroll Records.

PREVAILING WAGE – Contractors

Any public works project that has a total estimated project cost that equals or exceeds prevailing wage project thresholds requires a prevailing wage rate determination issued by the Department of Workforce Development (DWD). Public works include erecting, constructing, remodeling, repairing, demolishing, alterations, painting and decorating projects for a local governmental unit or state agency. State law excludes minor service or maintenance work, warranty work, or work under a supply-and-installation contract. There is a statutory definition for most of these exclusions. The prevailing wage laws that apply to local governmental units and their contractors are §§66.0903 and 103.503, Wis. Stats. The prevailing wage laws that apply to state agencies and their contractors are §§103.49 and 103.503, Wis. Stats. The applicable administrative rules for all prevailing wage projects are DWD 290 and DWD 294, Wis. Adm. Code. These laws include provisions that apply to all contractors and subcontractors working on prevailing wage projects.

Any contractor or subcontractor working on a local governmental unit or state agency's public works project that equals or exceeds current prevailing wage project thresholds must do all of the following:

- Receive and review the project's prevailing wage rate determination (i.e., white sheet).
- Tell subcontractors the project is subject to state prevailing wage law and include the prevailing wage rate determination in the construction contract, or if there is no written contract, provide a copy of the project determination to each subcontractor.
- Hire subcontractors who do *not* appear on the "Consolidated List of Debarred Contractors."
- Have a written substance abuse testing program in place that fulfills the requirements of §103.503, Wis. Stats., before commencing work on the project.

- Notify subcontractors that if DWD finds that a contractor or subcontractor violated the prevailing wage law, DWD will assess liquidated damages of 100% of the wages owed to employees.
- Apply to DWD for subjourney wage rates prior to employing these individuals on the project.
- Receive and retain a completed Affidavit of Compliance from each subcontractor brought on to the project before providing final payment to those subcontractors.
- Submit a completed Affidavit of Compliance to the contractor who brought the subcontractor on to the project before receiving final payment for the project.
- Maintain payroll records for 3 years that comply with §§66.0903(10)(a) or 103.49(5)(a), Stats. and DWD 274.06.
- Respond to requests from DWD or the project owner to provide payroll records and/or respond to prevailing wage complaints filed by employees or third parties.

For more information, visit the prevailing wage website: http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm. For further assistance, call the Equal Rights Division at 608-266-6861 and ask for prevailing wage.

Disclosure of Ownership

The statutory authority for the use of this form is prescribed in Sections 66.0903(12)(d), 66.0904(10)(d) and 103.49(7)(d), Wisconsin Statutes.

The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1) (m), Wisconsin Statutes].

- (1) On the date a contractor submits a bid to or completes negotiations with a state agency, local governmental unit, or developer, investor or owner on a project subject to Section 66.0903, 66.0904 or 103.49, Wisconsin Statutes, the contractor shall disclose to such state agency, local governmental unit, or developer, investor or owner, the name of any "other construction business," which the contractor, or a shareholder, officer or partner of the contractor, owns or has owned within the preceding three (3) years.
- (2) The term "other construction business" means any business engaged in the erection, construction, remodeling, repairing, demolition, altering or painting and decorating of buildings, structures or facilities. It also means any business engaged in supplying mineral aggregate, or hauling excavated material or spoil as provided by Sections 66.0903(3), 66.0904(2), 103.49(2) and 103.50(2), Wisconsin Statutes.
- (3) This form must **ONLY** be filed, with the state agency project owner, local governmental unit project owner, or developer, investor or owner of a publicly funded private construction project that will be awarding the contract, if **both (A) and (B) are met**.
 - (A) The contractor, or a shareholder, officer or partner of the contractor:
 - (1) Owns at least a 25% interest in the "other construction business," indicated below, on the date the contractor submits a bid or completes negotiations; or
 - (2) Has owned at least a 25% interest in the "other construction business" at any time within the preceding three (3) years.
 - (B) The Wisconsin Department of Workforce Development (DWD) has determined that the "other construction business" has failed to pay the prevailing wage rate or time and one-half the required hourly basic rate of pay, for hours worked in excess of the prevailing hours of labor, to any employee at any time within the preceding three (3) years.

Other Construction Business

Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code

I hereby state under penalty of perjury that the information, contained in this document, is true and accurate according to my knowledge and belief.

Print the Name of Authorized Officer

Authorized Officer Signature	Date Signed		
Corporation, Partnership or Sole Proprietorship Name			
Street Address or P O Box	City	State	Zip Code

If you have any questions call (608) 266-6861

Prime Contractor Affidavit of Compliance With Prevailing Wage Rate Determination

Authorization for this form is provided under Sections 66.0903(9)(c), 66.0904(7)(c) and 103.49(4r)(c) Wisconsin Statutes.

The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m), Wisconsin Statutes].

This form must **ONLY** be filed with the **Awarding Agency** indicated below.

State Of))SS County Of)	Project Name	
	DWD Determination Number	Project Number (if applicable)
	Date Determination Issued	Date of Contract
	Awarding Agency	
	Date Work Completed	

After being duly sworn, the person whose name and signature appears below hereby states under penalty of perjury that

- **I am** the duly authorized officer of the corporation, partnership, sole proprietorship or business indicated below and have recently completed all of the work required under the terms and conditions of a contract with the above-named awarding agency and make this affidavit in accordance with the requirements set forth in Section 66.0903(9)(c), 66.0904(7)(c) or 103.49(4r)(c), Wisconsin Statutes and Chapter DWD 290 of the Wisconsin Administrative Code in order to obtain FINAL PAYMENT from such awarding agency.
- **I have** fully complied with all the wage and hour requirements applicable to this project, including all of the requirements set forth in the prevailing wage rate determination indicated above which was issued for such project by the Department of Workforce Development on the date indicated above.
- **I have** received the required affidavit of compliance from each of my agents and subcontractors that performed work on this project and have listed each of their names and addresses on page 2 of this affidavit.
- **I have** full and accurate records that clearly indicate the name and trade or occupation of every worker(s) that I employed on this project, including an accurate record of the hours worked and actual wages paid to such worker(s).
- **I will** retain the records and affidavit(s) described above and make them available for inspection for a period of at least three (3) years from the completion date indicated above at the address indicated below and shall not remove such records or affidavit(s) without prior notification to the awarding agency indicated above.

Name of Corporation, Partnership, Sole Proprietorship, Business, State Agency or Local Governmental Unit				
Street Address	City	State	Zip Code	Telephone Number
Print Name of Authorized Officer			Date Signed	
Signature of Authorized Officer				

List of Agents and Subcontractors

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

If you have any questions call (608) 266-6861

Agent or Subcontractor Affidavit of Compliance With Prevailing Wage Rate Determination

Authorization for this form is provided under Sections 66.0903(9)(b), 66.0904(7)(b) and 103.49(4r)(9b), Wisconsin Statutes. The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.

Personal information you provide may be used for secondary purposes [Privacy Law, Section 15.04(1)(m), Wisconsin Statutes].

This form must **ONLY** be filed with the **Awarding Contractor** indicated below.

State Of _____))SS County Of _____)	Project Name	
	DWD Determination Number	Project Number (if applicable)
	Date Determination Issued	Date of Subcontract
	Awarding Contractor	
	Date Work Completed	

After being duly sworn, the person whose name and signature appears below hereby states under penalty of perjury that

- **I am** the duly authorized officer of the corporation, partnership, sole proprietorship or business indicated below. We have recently completed all of the work required under the terms and conditions of a subcontract with the above-named awarding contractor. We make this affidavit in accordance with the requirements set forth in Section 66.0903(9)(b), 66.0904(7)(b) or 103.49(4r)(b), Wisconsin Statutes and Chapter DWD 290 of the Wisconsin Administrative Code in order to obtain FINAL PAYMENT from such awarding contractor.
- **I have** fully complied with the entire wage and hour requirements applicable to this project, including all of the requirements set forth in the prevailing wage rate determination indicated above which was issued for such project by the Department of Workforce Development on the date indicated above.
- **I have** received the required affidavit of compliance from each of my agents and subcontractors that performed work on this project and have listed each of their names and addresses on page 2 of this affidavit.
- **I have** full and accurate records that clearly indicate the name and trade or occupation of every worker(s) that I employed on this project, including an accurate record of the hours worked and actual wages paid to such worker(s).
- **I will** retain the records and affidavit(s) described above and make them available for inspection for a period of at least three (3) years from the completion date indicated above at the address indicated below and shall not remove such records or affidavit(s) without prior notification to the awarding contractor.

Name of Corporation, Partnership, Sole Proprietorship, Business, State Agency or Local Governmental Unit				
Street Address or PO Box	City	State	Zip Code	Telephone Number ()
Print Name of Authorized Officer			Date Signed	
Authorized Officer Signature				

List of Agents and Subcontractors

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

If you have any questions call (608) 266-6861

Request to Employ Subjourneyperson

The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.

Personal information you provide may be used for secondary purposes (Privacy Law, s. 15.04(1)(m), Wisconsin Statutes).

The employer indicated below requests that the Department of Workforce Development (DWD) determine the prevailing wage rate(s) and related qualifications to enable such employer to use a subjourneyperson(s) on the following prevailing wage project, in accordance with the provisions of Section DWD 290.025, Wisconsin Administrative Code.

1. Name of Project Appearing on the Project Determination			
County	City, Village or Town		
DWD Project Determination Number	Project Number (if applicable)		
2. Job Classification(s) for which you request a subjourney rate (i.e., carpenter, electrician, plumber, etc.)			
a.	b.		
c.	d.		
3. Employer Name (Print)			
Address		City	State
Telephone Number ()		Zip Code	
Requester Title			
Email address (if you prefer to receive your response via email)		Fax Number (if you prefer to receive your response via fax) ()	

Requester Signature

Date Signed

MAIL the completed request to:

EQUAL RIGHTS DIVISION, LABOR STANDARDS BUREAU
PO BOX 8928, MADISON WI 53708

OR

FAX the completed request to: (608) 267-4592 / DO NOT e-mail your request.
Call (608) 266-6861 for assistance in completing this form.

ADDITIONAL GENERAL PREVAILING WAGE LAW INFORMATION

(This document updated July 2015)

NOTE: Recent prevailing wage law changes enacted by the 2015-17 Budget Bill (2015 Wisconsin Act 55) do not go into effect until calendar year 2017.

For prevailing wage laws and frequently asked questions, refer to the prevailing wage website at:
http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm

Topic	Who's affected?	Brief description of requirement under §66.0903 or §103.49
Non-applicability	All public entities	Prevailing wage rates do not apply to minor service or maintenance work, warranty work, or work under a supply and installation contract.
Non-applicability: Minor service or maintenance work	Local governmental units & Contractors	Minor service or maintenance work means a project of public works that is limited to • minor crack filling, chip or slurry sealing, or other minor pavement patching, not including overlays, that has a projected life span of no longer than 5 years or that is performed for a TOWN and is not funded under §86.31, regardless of projected life span; • the depositing of gravel on an existing gravel road applied solely to maintain the road; • road shoulder maintenance; • cleaning of drainage or sewer ditches or structures; or • any other limited, minor work on public facilities or equipment that is routinely performed to prevent breakdown or deterioration.
Non-applicability: Minor service or maintenance work	State agencies	Minor service or maintenance work means a project of public works that is limited to • minor crack filling, chip or slurry sealing, or other minor pavement patching, not including overlays, that has a projected life span of no longer than 5 years; • cleaning of drainage or sewer ditches or structures; or • any other limited, minor work on public facilities or equipment that is routinely performed to prevent breakdown or deterioration.
Non-applicability: Supply & installation contract	All public entities	Supply and installation contract means a contract under which the material is installed by means of simple fasteners or connectors such as screws or nuts and bolts and no other work is performed on the site of the project of public works, and the total labor cost to install the material does not exceed 20 percent of the total cost of the contract.
Non-applicability: Work which a contractor or individual donates to a public entity	All public entities	Prevailing wage laws §§66.0903 & 103.49, Stats., do not apply to work performed on a project of public works for which the local governmental unit or the state or the state agency contracting for the project is not required to compensate any contractor, subcontractor, contractor's or subcontractor's agent, or individual for performing the work.

Topic	Who's affected?	Brief description of requirement under §66.0903 or §103.49
Non-applicability: Residential	All public entities	A prevailing wage rate determination is not required for the erection, construction, repair, remodeling, or demolition of a residential property containing 2 dwelling units or less.
Non-applicability: Residential subdivision infrastructure	All public entities	A prevailing wage rate determination is not required for a road, street, bridge, sanitary sewer, or water main project that is a part of a development in which at least 90 percent of the lots contain or will contain 2 dwelling units or less, as determined by the local governmental unit at the time of approval of the development, and that, on completion, is acquired by, or dedicated to, a local governmental unit (including under §236.13(2), Stats.), or the state, for ownership or maintenance by the local governmental unit or the state.
Electronic certified payroll record	Contractors	The requirement that every contractor on a prevailing wage project submit to DWD monthly a certified record of employees who worked on the project and that DWD post these certified records on its Internet website was discontinued effective July 1, 2011. Contractors are still required to maintain payroll records and provide them upon request from DWD &/or the project owner.
Payroll record inspection request by any person	Contractors & Complainants	Any person may request DWD to inspect the payroll records of any contractor working on a prevailing wage project. On receipt of such a request, the contractor must submit to DWD a certified record of its payroll records, other than personally identifiable information relating to an employee of the contractor, for no longer than a 4-week period. DWD may request records from a contractor under this provision no more than once per calendar quarter for each project of public works on which the contractor is performing work. The department may not charge a requester a fee for obtaining that information. DWD must make these certified records available for public inspection.
Statewide uniformity	Local governmental units	A local governmental unit may not enact & administer a prevailing wage ordinance/provision for public works or publicly funded private construction projects. Any extant laws to that effect are void.
Substance Abuse Testing	Contractors & Workers	Before commencing work on a prevailing wage project, a contractor must have a written substance abuse testing program in place that complies with §103.503, Wis. Stats. No employee may use, possess, attempt to possess, distribute, deliver, or be under the influence of a drug or under the influence of alcohol while performing work on a prevailing wage project.

Topic	Who's affected	Brief description of requirement under §66.0903 or §103.49
Covered employees	Truck drivers & Other workers & Contractors	A laborer, worker, mechanic, or truck driver who is employed to process, manufacture, pick up, or deliver materials or products from a commercial establishment that has a fixed place of business from which the establishment supplies processed or manufactured materials or products or from a facility that is not dedicated exclusively, or nearly so, to a project of public works is NOT entitled to receive the prevailing wage rate UNLESS any of the following applies: 1) the laborer, worker, mechanic, or truck driver is employed to go to the source of mineral aggregate such as sand, gravel, or stone and deliver that mineral aggregate to the site of a project of public works by depositing the material directly in final place, from the transporting vehicle or through spreaders from the transporting vehicle. 2) the laborer, worker, mechanic, or truck driver is employed to go to the site of a project of public works, pick up excavated material or spoil from the site of the project, and transport that excavated material or spoil away from the site of the project.

FEBRUARY 1999

**NOTICE TO BIDDERS
WAGE RATE DECISION**

The wage rate decision of the Secretary of Labor which has been incorporated in these advertised specifications is incomplete in that the classifications may be omitted from the Secretary 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. The higher of state or federal rate will apply.

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
20160308003PROJECT(S):
1070-00-71FEDERAL ID(S):
WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS

SECTION 0001 Contract Items

0010	201.0215 Grubbing	2.820 ACRE	.		.	
0020	204.0100 Removing Pavement	12,164.000 SY	.		.	
0030	204.0130 Removing Curb	338.000 LF	.		.	
0040	204.0155 Removing Concrete Sidewalk	1,095.000 SY	.		.	
0050	204.0165 Removing Guardrail	60.000 LF	.		.	
0060	204.0170 Removing Fence	789.000 LF	.		.	
0070	204.0175 Removing Concrete Slope Paving	4.000 SY	.		.	
0080	204.0195 Removing Concrete Bases	19.000 EACH	.		.	
0090	204.0205 Removing Utility Poles	19.000 EACH	.		.	
0100	204.0210 Removing Manholes	2.000 EACH	.		.	

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
20160308003PROJECT(S):
1070-00-71FEDERAL ID(S):
WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0110	204.0220 Removing Inlets	8.000				
	EACH		.		.	
0120	204.0240 Site Clearance (parcel) 01. Existing Rest Area 31	LUMP	LUMP			.
0130	204.0245 Removing Storm Sewer (size) 01. 12-Inch	64.000				
	LF		.		.	
0140	204.0245 Removing Storm Sewer (size) 02. 18-Inch	745.000				
	LF		.		.	
0150	204.0265 Abandoning Wells	1.000				
	EACH		.		.	
0160	204.9060.S Removing (item description) 01. Pull Box	2.000				
	EACH		.		.	
0170	204.9060.S Removing (item description) 02. Flag Pole	1.000				
	EACH		.		.	
0180	204.9060.S Removing (item description) 03. Planter	1.000				
	EACH		.		.	
0190	204.9060.S Removing (item description) 04. Yard Hydrant And Supply Piping	6.000				
	EACH		.		.	
0200	204.9090.S Removing (item description) 01. Sanitary Sewer Pipe (6-Inch)	278.000				
	LF		.		.	

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
20160308003PROJECT(S):
1070-00-71FEDERAL ID(S):
WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0210	204.9090.S Removing (item description) 02. Sanitary Sewer Pipe (8-Inch)	116.000 LF	.		.	
0220	205.0100 Excavation Common	12,845.000 CY	.		.	
0230	206.3000 Excavation for Structures Retaining Walls (structure) 01. R-32-65	LUMP	LUMP		.	
0240	213.0100 Finishing Roadway (project) 01. 1070-00-71	1.000 EACH	.		.	
0250	305.0120 Base Aggregate Dense 1 1/4-Inch	6,668.000 TON	.		.	
0260	405.0100 Coloring Concrete Red	27.000 CY	.		.	
0270	415.0080 Concrete Pavement 8-Inch	5,797.000 SY	.		.	
0280	415.0100 Concrete Pavement 10-Inch	8,994.000 SY	.		.	
0290	416.0160 Concrete Driveway 6-Inch	270.000 SY	.		.	
0300	416.0508 Concrete Roundabout Truck Apron 8-Inch	118.000 SY	.		.	

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
20160308003PROJECT(S):
1070-00-71FEDERAL ID(S):
WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0310	504.0500 Concrete Masonry Retaining Walls	19.000 CY	.		.	
0320	505.0600 Bar Steel Reinforcement HS Coated Structures	1,220.000 LB	.		.	
0330	512.0500 Piling Steel Sheet Permanent Delivered	3,440.000 SF	.		.	
0340	512.0600 Piling Steel Sheet Permanent Driven	3,440.000 SF	.		.	
0350	516.0500 Rubberized Membrane Waterproofing	3.000 SY	.		.	
0360	522.0118 Culvert Pipe Reinforced Concrete Class III 18-Inch	47.000 LF	.		.	
0370	522.0318 Culvert Pipe Reinforced Concrete Class IV 18-Inch	53.000 LF	.		.	
0380	522.1015 Apron Endwalls for Culvert Pipe Reinforced Concrete 15-Inch	2.000 EACH	.		.	
0390	522.1018 Apron Endwalls for Culvert Pipe Reinforced Concrete 18-Inch	5.000 EACH	.		.	
0400	522.1024 Apron Endwalls for Culvert Pipe Reinforced Concrete 24-Inch	1.000 EACH	.		.	

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
20160308003PROJECT(S):
1070-00-71FEDERAL ID(S):
WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0410	523.0519 Apron Endwalls for Culvert Pipe Reinforced Concrete Horizontal Elliptical 19x30-Inch	EACH 1.000	.		.	
0420	601.0551 Concrete Curb & Gutter 4-Inch Sloped 36-Inch Type A	LF 209.000	.		.	
0430	602.0410 Concrete Sidewalk 5-Inch	SF 18,214.000	.		.	
0440	602.0415 Concrete Sidewalk 6-Inch	SF 1,408.000	.		.	
0450	602.0505 Curb Ramp Detectable Warning Field Yellow	SF 103.000	.		.	
0460	606.0200 Riprap Medium	CY 24.000	.		.	
0470	606.0700 Grouted Riprap Heavy	CY 3.000	.		.	
0480	608.0315 Storm Sewer Pipe Reinforced Concrete Class III 15-Inch	LF 787.000	.		.	
0490	608.0318 Storm Sewer Pipe Reinforced Concrete Class III 18-Inch	LF 285.000	.		.	
0500	608.0324 Storm Sewer Pipe Reinforced Concrete Class III 24-Inch	LF 65.000	.		.	

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
20160308003PROJECT(S):
1070-00-71FEDERAL ID(S):
WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0510	610.0419 Storm Sewer Pipe Reinforced Concrete Horizontal Elliptical Class HE-IV 19x30-Inch	87.000 LF	.		.	
0520	611.0530 Manhole Covers Type J	1.000 EACH	.		.	
0530	611.0535 Manhole Covers Type J-Special	3.000 EACH	.		.	
0540	611.0615 Inlet Covers Type F	2.000 EACH	.		.	
0550	611.0624 Inlet Covers Type H	8.000 EACH	.		.	
0560	611.0639 Inlet Covers Type H-S	1.000 EACH	.		.	
0570	611.0642 Inlet Covers Type MS	3.000 EACH	.		.	
0580	611.0645 Inlet Covers Type MS-A	1.000 EACH	.		.	
0590	611.2004 Manholes 4-FT Diameter	1.000 EACH	.		.	
0600	611.3004 Inlets 4-FT Diameter	6.000 EACH	.		.	
0610	611.3230 Inlets 2x3-FT	5.000 EACH	.		.	

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0620	611.3901 Inlets Median 1 Grate	3.000 EACH	.		.	
0630	611.3902 Inlets Median 2 Grate	1.000 EACH	.		.	
0640	611.9800.S Pipe Grates	3.000 EACH	.		.	
0650	612.0206 Pipe Underdrain Unperforated 6-Inch	117.000 LF	.		.	
0660	612.0406 Pipe Underdrain Wrapped 6-Inch	509.000 LF	.		.	
0670	612.0902.S Insulation Board Polystyrene (inch) 01. 2-Inch	198.000 SY	.		.	
0680	616.0206 Fence Chain Link 6-FT	706.000 LF	.		.	
0690	616.0329 Gates Chain Link (width) 01. 8-Ft	2.000 EACH	.		.	
0700	616.0329 Gates Chain Link (width) 02. 4-Ft	1.000 EACH	.		.	
0710	618.0100 Maintenance And Repair of Haul Roads (project) 01. 1070-00-71	1.000 EACH	.		.	
0720	619.1000 Mobilization	1.000 EACH	.		.	

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0730	620.0300 Concrete Median Sloped Nose	44.000 SF	.		.	
0740	624.0100 Water	800.000 MGAL	.		.	
0750	625.0500 Salvaged Topsoil	22,738.000 SY	.		.	
0760	627.0200 Mulching	10,769.000 SY	.		.	
0770	628.1504 Silt Fence	2,327.000 LF	.		.	
0780	628.1520 Silt Fence Maintenance	4,654.000 LF	.		.	
0790	628.1905 Mobilizations Erosion Control	2.000 EACH	.		.	
0800	628.1910 Mobilizations Emergency Erosion Control	4.000 EACH	.		.	
0810	628.2004 Erosion Mat Class I Type B	2,462.000 SY	.		.	
0820	628.2021 Erosion Mat Class II Type A	40.000 SY	.		.	
0830	628.2027 Erosion Mat Class II Type C	1,144.000 SY	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0840	628.7005 Inlet Protection Type A	13.000 EACH	.		.	
0850	628.7010 Inlet Protection Type B	2.000 EACH	.		.	
0860	628.7015 Inlet Protection Type C	11.000 EACH	.		.	
0870	628.7504 Temporary Ditch Checks	30.000 LF	.		.	
0880	628.7555 Culvert Pipe Checks	8.000 EACH	.		.	
0890	628.7560 Tracking Pads	1.000 EACH	.		.	
0900	629.0210 Fertilizer Type B	23.000 CWT	.		.	
0910	630.0130 Seeding Mixture No. 30	148.000 LB	.		.	
0920	630.0140 Seeding Mixture No. 40	54.000 LB	.		.	
0930	630.0175 Seeding Mixture No. 75	8.000 LB	.		.	
0940	630.0200 Seeding Temporary	306.000 LB	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0950	631.0300 Sod Water	6.000				
		MGAL	.		.	
0960	631.1200 Sod Erosion Control Sandy Soil	40.000				
		SY	.		.	
0970	632.0101 Trees (species) (size) (root) 01. Northwoods Red Maple 1 3/4-Inch Cal B&B	10.000				
		EACH	.		.	
0980	632.0101 Trees (species) (size) (root) 02. Thornless Hawthorn 1 3/4-Inch Cal B&	9.000				
		EACH	.		.	
0990	632.0101 Trees (species) (size) (root) 03. Common Hackberry 1 3/4-Inch Cal B&B	1.000				
		EACH	.		.	
1000	632.0101 Trees (species) (size) (root) 04. Shademaster Honeylocust 1 3/4-Inch Cal B&B	5.000				
		EACH	.		.	
1010	632.0101 Trees (species) (size) (root) 05. Prairiefire Flowering Crab 1 3/4-Inch Cal B&B	7.000				
		EACH	.		.	
1020	632.0101 Trees (species) (size) (root) 06. Ironwood 1 3/4-Inch Cal B&B	3.000				
		EACH	.		.	
1030	632.0101 Trees (species) (size) (root) 07. Quaking Aspen #25 Cg	3.000				
		EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1040	632.0101 Trees (species) (size) (root) 08. Swamp White Oak 1 3/4-Inch Cal B&B	12.000 EACH	.		.	
1050	632.0101 Trees (species) (size) (root) 09. Bur Oak 1 3/4-Inch Cal B&B	3.000 EACH	.		.	
1060	632.0101 Trees (species) (size) (root) 10. Clump River Birch 6-Ft Ht B&B	3.000 EACH	.		.	
1070	632.0101 Trees (species) (size) (root) 11. Autumn Brilliance Serviceberry 1 3/4 Inch Cal B&B	2.000 EACH	.		.	
1080	632.0101 Trees (species) (size) (root) 12. New Horizon Elm 1 3/4-Inch Cal B&B	21.000 EACH	.		.	
1090	632.0101 Trees (species) (size) (root) 13. Black Hills Spruce 5-Ft Ht B&B	2.000 EACH	.		.	
1100	632.0101 Trees (species) (size) (root) 14. Red Pine 5-Ft Ht B&B	12.000 EACH	.		.	
1110	632.0101 Trees (species) (size) (root) 15. White Pine 5-Ft Ht B&B	7.000 EACH	.		.	
1120	632.0101 Trees (species) (size) (root) 16. Techny Arborvitae #10 Cg	24.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1130	632.0201 Shrubs (species) (size) (root) 01. Peking Cotoneaster #2 Cg	11.000 EACH	.		.	
1140	632.0201 Shrubs (species) (size) (root) 02. Red-Twig Dogwood #2 Cg	26.000 EACH	.		.	
1150	632.0201 Shrubs (species) (size) (root) 03. Dwarf Bush Honeysuckle #2 Cg	31.000 EACH	.		.	
1160	632.0201 Shrubs (species) (size) (root) 04. Little Quick Fire Hydrangea #2 Cg	6.000 EACH	.		.	
1170	632.0201 Shrubs (species) (size) (root) 05. Gro-Low Sumac #2 Cg	35.000 EACH	.		.	
1180	632.0201 Shrubs (species) (size) (root) 06. Daphne Spirea #2 Cg	24.000 EACH	.		.	
1190	632.0201 Shrubs (species) (size) (root) 07. Little Princess Spirea #2 Cg	12.000 EACH	.		.	
1200	632.0201 Shrubs (species) (size) (root) 08. Miss Kim Lilac #2 Cg	12.000 EACH	.		.	
1210	632.0201 Shrubs (species) (size) (root) 09. Arrowwood Viburnum 3-Ft Ht Cg	20.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1220	632.0201 Shrubs (species) (size) (root) 10. Mohican Viburnum 3-Ft Ht Cg	EACH 3.000	.		.	
1230	632.0201 Shrubs (species) (size) (root) 11. Calgary Carpet Juniper #2 Cg	EACH 14.000	.		.	
1240	632.9101 Landscape Planting Surveillance and Care Cycles	EACH 20.000	.		.	
1250	633.0100 Delineator Posts Steel	EACH 8.000	.		.	
1260	633.0500 Delineator Reflectors	EACH 8.000	.		.	
1270	633.5200 Markers Culvert End	EACH 9.000	.		.	
1280	634.0614 Posts Wood 4x6-Inch X 14-FT	EACH 32.000	.		.	
1290	634.0616 Posts Wood 4x6-Inch X 16-FT	EACH 12.000	.		.	
1300	634.0618 Posts Wood 4x6-Inch X 18-FT	EACH 2.000	.		.	
1310	636.0100 Sign Supports Concrete Masonry	CY 5.000	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1320	636.1000 Sign Supports Steel Reinforcement HS	350.000 LB	.		.	
1330	637.1220 Signs Type I Reflective SH	50.800 SF	.		.	
1340	637.2210 Signs Type II Reflective H	239.000 SF	.		.	
1350	637.2230 Signs Type II Reflective F	13.300 SF	.		.	
1360	638.2602 Removing Signs Type II	47.000 EACH	.		.	
1370	638.3000 Removing Small Sign Supports	28.000 EACH	.		.	
1380	639.0108 Drill Hole in Earth 8-Inch	40.000 LF	.		.	
1390	639.0112 Drill Hole in Earth 12-Inch	120.000 LF	.		.	
1400	639.1008 Well Casing Pipe 8-Inch	142.000 LF	.		.	
1410	639.1700 Well Screen	20.000 LF	.		.	
1420	639.2100 Grout for Sealing Well Casing	54.000 CF	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1430	639.4000 Test Pumping	2.000				
	EACH		.		.	
1440	641.8100 Overhead Sign Support (structure) 01. S-32-67	LUMP	LUMP		.	
1450	642.5401 Field Office Type D	1.000			.	
	EACH		.		.	
1460	643.0100 Traffic Control (project) 01. 1070-00-71	1.000			.	
	EACH		.		.	
1470	643.0300 Traffic Control Drums	40.000			.	
	DAY		.		.	
1480	643.0420 Traffic Control Barricades Type III	642.000			.	
	DAY		.		.	
1490	643.0705 Traffic Control Warning Lights Type A	428.000			.	
	DAY		.		.	
1500	643.0900 Traffic Control Signs	1,503.000			.	
	DAY		.		.	
1510	645.0120 Geotextile Fabric Type HR	76.000			.	
	SY		.		.	
1520	646.0106 Pavement Marking Epoxy 4-Inch	231.000			.	
	LF		.		.	
1530	646.0126 Pavement Marking Epoxy 8-Inch	60.000			.	
	LF		.		.	

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1540	647.0156 Pavement Marking Arrows Epoxy Type 1	4.000 EACH	.		.	
1550	647.0256 Pavement Marking Symbols Epoxy	4.000 EACH	.		.	
1560	647.0456 Pavement Marking Curb Epoxy	24.000 LF	.		.	
1570	647.0566 Pavement Marking Stop Line Epoxy 18-Inch	19.000 LF	.		.	
1580	647.0606 Pavement Marking Island Nose Epoxy	1.000 EACH	.		.	
1590	647.0656 Pavement Marking Parking Stall Epoxy	3,375.000 LF	.		.	
1600	647.0706 Pavement Marking Diagonal Epoxy 6-Inch	383.000 LF	.		.	
1610	647.0766 Pavement Marking Crosswalk Epoxy 6-Inch	112.000 LF	.		.	
1620	647.0776 Pavement Marking Crosswalk Epoxy 12-Inch	42.000 LF	.		.	
1630	647.0796 Pavement Marking Crosswalk Epoxy 24-Inch	133.000 LF	.		.	
1640	650.4000 Construction Staking Storm Sewer	21.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1650	650.4500 Construction Staking Subgrade	3,203.000 LF	.		.	
1660	650.5500 Construction Staking Curb Gutter and Curb & Gutter	5,935.000 LF	.		.	
1670	650.6000 Construction Staking Pipe Culverts	2.000 EACH	.		.	
1680	650.6500 Construction Staking Structure Layout (structure) 01. R-32-65	LUMP	LUMP		.	
1690	650.6500 Construction Staking Structure Layout (structure) 02. S-32-67	LUMP	LUMP		.	
1700	650.7000 Construction Staking Concrete Pavement	3,241.000 LF	.		.	
1710	650.8500 Construction Staking Electrical Installations (project) 01. 1070-00-71	LUMP	LUMP		.	
1720	650.9910 Construction Staking Supplemental Control (project) 01. 1070-00-71	LUMP	LUMP		.	
1730	650.9920 Construction Staking Slope Stakes	3,203.000 LF	.		.	
1740	652.0210 Conduit Rigid Nonmetallic Schedule 40 1-Inch	27.000 LF	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1750	652.0225 Conduit Rigid Nonmetallic Schedule 40 2-Inch	9,408.000 LF	.		.	
1760	652.0800 Conduit Loop Detector	60.000 LF	.		.	
1770	653.0115 Pull Boxes Steel 12x36-Inch	7.000 EACH	.		.	
1780	653.0130 Pull Boxes Steel 18x36-Inch	2.000 EACH	.		.	
1790	653.0135 Pull Boxes Steel 24x36-Inch	1.000 EACH	.		.	
1800	653.0145 Pull Boxes Steel 24x48-Inch	4.000 EACH	.		.	
1810	654.0101 Concrete Bases Type 1	1.000 EACH	.		.	
1820	654.0106 Concrete Bases Type 6	21.000 EACH	.		.	
1830	654.0111 Concrete Bases Type 11	26.000 EACH	.		.	
1840	655.0144 Cable In Duct 4-4 AWG	211.000 LF	.		.	
1850	655.0610 Electrical Wire Lighting 12 AWG	11,738.000 LF	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1860	655.0615 Electrical Wire Lighting 10 AWG	7,394.000 LF	.		.	
1870	655.0620 Electrical Wire Lighting 8 AWG	6,884.000 LF	.		.	
1880	655.0625 Electrical Wire Lighting 6 AWG	6,255.000 LF	.		.	
1890	655.0800 Loop Detector Wire	279.000 LF	.		.	
1900	657.0100 Pedestal Bases	26.000 EACH	.		.	
1910	657.0255 Transformer Bases Breakaway 11 1/2-Inch Bolt Circle	21.000 EACH	.		.	
1920	657.0327 Poles Type 6-Aluminum	21.000 EACH	.		.	
1930	657.0610 Luminaire Arms Single Member 4 1/2-Inch Clamp 6-FT	11.000 EACH	.		.	
1940	657.0715 Luminaire Arms Truss Type 4 1/2-Inch Clamp 15-FT	15.000 EACH	.		.	
1950	659.1115 Luminaires Utility LED A	19.000 EACH	.		.	
1960	659.1130 Luminaires Utility LED D	7.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1970	671.0112 Conduit HDPE 1-Duct 2-Inch	792.000 LF	.		.	
1980	673.0105 Communication Vault Type 1	1.000 EACH	.		.	
1990	690.0150 Sawing Asphalt	24.000 LF	.		.	
2000	715.0415 Incentive Strength Concrete Pavement	4,493.000 DOL	1.00000		4493.00	
2010	999.1800.S Picnic Tables Single Pedestal	10.000 EACH	.		.	
2020	ASP.1T0A On-the-Job Training Apprentice at \$5.00/HR	200.000 HRS	5.00000		1000.00	
2030	SPV.0005 Special 01. Tree Shrub And Groundcover Watering	4.000 ACRE	.		.	
2040	SPV.0005 Special 02. Tree Trimming **P**	0.150 ACRE	.		.	
2050	SPV.0035 Special 01. Double Shredded Hardwood Mulch	12.000 CY	.		.	
2060	SPV.0035 Special 02. Planter Soil	25.000 CY	.		.	
2070	SPV.0035 Special 03. Engineered Soil	580.000 CY	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
2080	SPV.0035 Special 04. Limestone Screenings	60.000 CY	.		.	
2090	SPV.0055 Special 01. Telephone Service	2,000.000 DOL	1.00000		2000.00	
2100	SPV.0055 Special 02. Electrical Service	5,000.000 DOL	1.00000		5000.00	
2110	SPV.0055 Special 03. Natural Gas Service	7,500.000 DOL	1.00000		7500.00	
2120	SPV.0060 Special 01. Gates Chain Link Slatted 8-Ft	2.000 EACH	.		.	
2130	SPV.0060 Special 02. Gates Chain Link Slatted 12-Ft	1.000 EACH	.		.	
2140	SPV.0060 Special 03. Pitless Adapter	2.000 EACH	.		.	
2150	SPV.0060 Special 04. Well Pump	2.000 EACH	.		.	
2160	SPV.0060 Special 05. Salvaged Trash Receptacles	10.000 EACH	.		.	
2170	SPV.0060 Special 06. Salvaged Cigarette Snuffers	2.000 EACH	.		.	
2180	SPV.0060 Special 07. Flagpoles	2.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
2190	SPV.0060 Special 08. Benches	6.000 EACH	.		.	
2200	SPV.0060 Special 09. Trash Receptacles	2.000 EACH	.		.	
2210	SPV.0060 Special 10. Salvaged Recycle Receptacles	17.000 EACH	.		.	
2220	SPV.0060 Special 11. Walkway Lighting Units	26.000 EACH	.		.	
2230	SPV.0060 Special 12. Sanitary Sewer Manhole 4-Ft	3.000 EACH	.		.	
2240	SPV.0060 Special 13. Moving Historical Sign	2.000 EACH	.		.	
2250	SPV.0060 Special 14. Wall Mounted Lighting Fixture	15.000 EACH	.		.	
2260	SPV.0060 Special 15. Moving Veterans Sign	1.000 EACH	.		.	
2270	SPV.0060 Special 16. Pet Waste Station	1.000 EACH	.		.	
2280	SPV.0060 Special 17. Picnic Shelter	3.000 EACH	.		.	
2290	SPV.0060 Special 18. Portable Planters	1.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
2300	SPV.0060 Special 19. Gabion Planter Wisconsin Sign	1.000 EACH	.		.	
2310	SPV.0060 Special 20. Gabion Planter Saw Blade	1.000 EACH	.		.	
2320	SPV.0060 Special 21. Gabion Planter Trees	2.000 EACH	.		.	
2330	SPV.0060 Special 22. Gabion Column	4.000 EACH	.		.	
2340	SPV.0060 Special 23. Linear Gabion Planter	2.000 EACH	.		.	
2350	SPV.0060 Special 24. Curved Gabion Planter	1.000 EACH	.		.	
2360	SPV.0060 Special 25. Gabion Column Interpretive Sign	4.000 EACH	.		.	
2370	SPV.0060 Special 26. Gabion Column Fence	1.000 EACH	.		.	
2380	SPV.0060 Special 27. Karl Foerster Feather Reed Grass 4-In Pot	26.000 EACH	.		.	
2390	SPV.0060 Special 28. Stella D'Oro Daylilly 4-In Pot	48.000 EACH	.		.	
2400	SPV.0060 Special 29. Flame Grass 4-In Pot	19.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
2410	SPV.0060 Special 30. Walker's Low Catmint 4-In Pot	10.000 EACH	.		.	
2420	SPV.0060 Special 31. Emerald Pink Creeping Phlox 4-In Pot	66.000 EACH	.		.	
2430	SPV.0060 Special 32. Northwind Switch Grass 4-In Pot	3.000 EACH	.		.	
2440	SPV.0060 Special 33. Prairie Drop Seed 4-In Pot	110.000 EACH	.		.	
2450	SPV.0060 Special 34. Sanitary Sewer Cleanout 6-Inch	1.000 EACH	.		.	
2460	SPV.0060 Special 35. Floodlight Lighting Fixture	4.000 EACH	.		.	
2470	SPV.0060 Special 36. Flexible Lighting Fixture	4.000 EACH	.		.	
2480	SPV.0060 Special 37. Floodlight Landscape Lighting Fixture	13.000 EACH	.		.	
2490	SPV.0090 Special 01. Fence Chain Link Slatted 8-Ft	153.000 LF	.		.	
2500	SPV.0090 Special 02. Sanitary Sewer Pvc 6-Inch	217.000 LF	.		.	
2510	SPV.0090 Special 03. Sanitary Sewer Pvc 8-Inch	225.000 LF	.		.	

Wisconsin Department of Transportation

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DATE: 01/28/16

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
20160308003PROJECT(S):
1070-00-71FEDERAL ID(S):
WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2520	SPV.0090 Special 04. Underground Copper Water Line 2-In	363.000 LF	.		.	
2530	SPV.0090 Special 05. Construction Staking Sanitary Sewer System	442.000 LF	.		.	
2540	SPV.0090 Special 06. Underground Copper Water Line 1-In	372.000 LF	.		.	
2550	SPV.0090 Special 07. Steel Landscape Edging 1/4-In x 6-In Black	762.000 LF	.		.	
2560	SPV.0090 Special 08. Concrete Curb And Gutter 36-Inch Type A Special	5,726.000 LF	.		.	
2570	SPV.0090 Special 09. Stainless Steel Handrail	59.000 LF	.		.	
2580	SPV.0090 Special 10. Cable In Duct 3-1/0 AWG	443.000 LF	.		.	
2590	SPV.0090 Special 11. Electrical Wire Power 6 AWG	443.000 LF	.		.	
2600	SPV.0105 Special 01. Rest Area 31 Maintenance Building	LUMP	LUMP		.	
2610	SPV.0105 Special 02. Rest Area 31 Building General Construction	LUMP	LUMP		.	
2620	SPV.0105 Special 03. Rest Area 31 Building Plumbing	LUMP	LUMP		.	

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
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WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2630	SPV.0105 Special 04. Rest Area Building Heating And Ventilation	LUMP	LUMP			.
2640	SPV.0105 Special 05. Rest Area Building Electrical	LUMP	LUMP			.
2650	SPV.0105 Special 06. Play Equipment Rest Area 31	LUMP	LUMP			.
2660	SPV.0105 Special 07. Play Lot Surfacing Rest Area 31	LUMP	LUMP			.
2670	SPV.0105 Special 08. Well System Controls Rest Area 31	LUMP	LUMP			.
2680	SPV.0105 Special 09. Construction Staking Joint Layout	LUMP	LUMP			.
2690	SPV.0165 Special 01. Temporary Shoring Special	SF 240.000	.			.
2700	SPV.0165 Special 02. Construction Staking Sidewalk	SF 19,613.000	.			.
2710	SPV.0165 Special 03. Gravity Wall Modular Block Landscape **p**	SF 702.000	.			.
2720	SPV.0165 Special 04. Soil Nail Reinforced Slope	SF 2,892.000	.			.
2730	SPV.0180 Special 01. Concrete Pavement 8-Inch Colored	SY 63.000	.			.

Wisconsin Department of Transportation

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REVISED:

SCHEDULE OF ITEMS

CONTRACT:
20160308003

PROJECT(S):
1070-00-71

FEDERAL ID(S):
WISC 2016045

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2740	SPV.0180 Special 02. Wet Mesic Prairie	1,839.000 SY	.		.	
2750	SPV.0180 Special 03. Sod - Kentucky Blue And Fescue Mix	1,567.000 SY	.		.	
2760	SPV.0195 Special 01. Mississippi River Rock	142.000 TON	.		.	
	SECTION 0001 TOTAL				.	
	TOTAL BID				.	

PLEASE ATTACH SCHEDULE OF ITEMS HERE