HIGHWAY WORK PROPOSAL

Wisconsin Department of Transportation
06/2017 s.66.0901(7) Wis. Stats

Proposal Number: 009

COUNTY	STATE PROJECT	FEDERAL	PROJECT DESCRIPTION	HIGHWAY
Waukesha	1060-62-70	N/A	East West Freeway; Grandview Boulevard Salt Shed	IH 094

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 Date: July 10, 2018 Time (Local Time): 9:00 am	Firm Name, Address, City, State, Zip Code SAMPLE NOT FOR BIDDING PURPOSES
Contract Completion Time 130 Working Days	
Assigned Disadvantaged Business Enterprise Goal 0%	This contract is exempt from federal oversight.

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

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

Subscribed and sworn to before me this date _____

(Signature, Notary Public, State of Wisconsin)	(Bidder Signature)
(Print or Type Name, Notary Public, State Wisconsin)	(Print or Type Bidder Name)
(Date Commission Expires)	(Bidder Title)

Notary Seal

For Department Use Only

Type of Work:
Grading, Base, Storm Sewer, Culvert Pipe, Concrete Pavement, Asphalt Pavement, Landscaping, Salt Shed, Brine Making Facilities

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 Express web site.
2. Use Expedite™ software to enter a unit price for every item in the schedule of items.
3. Submit the bid according to the requirements of Expedite™ software and the Bid Express™ web site. Do not submit a bid on a printout with accompanying diskette or CD ROM or a paper bid. If the bidder does submit a bid on a printout with accompanying diskette or a paper bid in addition to the internet submittal, the department will disregard the internet bid.
4. Submit the bid before the hour and date the Notice to Contractors designates.
5. Do not sign, notarize, and return the bidding proposal described in 102.2 of the standard specifications.

(3) The department will not consider the bid accepted until the hour and date the Notice to Contractors designates.

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

(1) Download the latest schedule of items from the Wisconsin pages of the Bid Express™ web site reflecting the latest addenda posted on the department's web site at:

http://wisconsindot.gov/Pages/doing-bus/contractors/hcci/bid-let.aspx

Use Expedite ™ software to prepare and print the schedule of items. Provide a valid amount for all price fields. Follow instructions and review the help screens provided on the Bid Express™ web site to assure that the schedule of items is prepared properly.

(2) Staple an 8 1/2 by 11 inch printout of the Expedite™ generated schedule of items to the other proposal documents submitted to the department as a part of the bidder's sealed bid. As a separate submittal not in the sealed bid envelop but due at the same time and place as the sealed bid, also provide the Expedite™ generated schedule of items on a 3 1/2 inch computer diskette or CD ROM. Label each diskette or CD ROM with the bidder's name, the 4 character department-assigned bidder identification code from the top of the bidding proposal, and a list of the proposal numbers included on that diskette or CD ROM as indicated in the following example:

Bidder

Name

BN00

Proposals: 1, 12, 14, & 22

(3) If bidding on more than one proposal in the letting, the bidder may include all proposals for that letting on one diskette or CD ROM. Include only submitted proposals with no incomplete or other files on the diskette or CD ROM.

(4) The bidder-submitted printout of the Expedite™ generated schedule of items is the governing contract document and must conform to the requirements of section 102 of the standard specifications. If a printout needs to be altered, cross out the printed information with ink or typewriter and enter the new information and initial it in ink. If there is a discrepancy between the printout and the diskette or CD ROM, the department will analyze the bid using the printout information.

(5) In addition to the reasons specified in section 102 of the standard specifications, proposals are irregular and the department may reject them for one or more of the following:

1. The check code printed on the bottom of the printout of the Expedite™ generated schedule of items is not the same on each page.
2. The check code printed on the printout of the Expedite™ 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

Wisconsin Department of Transportation

DT1303 1/2006

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)

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

(Signature of Attorney-in-Fact)

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

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

Wisconsin Department of Transportation

DT1305 8/2003

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.

Name of Subcontractor	Class of Work	Estimated Value

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 1060-62-70, East West Freeway, Grandview Boulevard Salt Shed, IH-94, Waukesha 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, 2018 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 (20171130)

2. Scope of Work.

The work under this contract shall consist of excavation common, grading, concrete and asphalt paving, storm sewer installation, construction of a 15,000 ton salt shed and brine making facility with storage tanks, and installation of a 30,000 Gallon underground storage tank, and all incidental items necessary to complete the work as shown on the plans and included in the proposal and contract.

3. Waiving Bidder Prequalification.

Bidder prequalification is not required; however, prior to awarding a contract, the department may require the bidder to produce financial documentation similar to the prequalification statement (DT1621) and evidence that they have a history of performing work of a similar character in a satisfactory manner.

4. Prosecution and Progress.

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

Provide the time frame for construction of the project within the 2018 / 2019 construction season to the engineer in writing within a month after executing the contract but at least 14 calendar days before the preconstruction conference. Assure that the time frame is consistent with the contract completion time. Upon approval, the engineer will issue the notice to proceed within ten calendar days before the beginning of the approved time frame.

To revise the time frame, submit a written request to the engineer at least two weeks before the beginning of the intended time frame. 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.

Stage 1 construction to include all associated brine building and salt shed structure design, fabrication, delivery, foundations, and construction, common excavation, underground detention tank installation, culvert pipes, storm sewer pipe and structures, lighting, utility service installations, scale installation, final and temporary landscaping as shown in stage 1 erosion control plan details.

Stage 2 construction to include base aggregate for driveway construction, HMA paving for driveway and salt shed, concrete paving for driveway, and pond construction. Final landscaping will not take place without written approval from engineer based on season growing conditions, and not prior to May 14, 2019. Final landscaping is to include all tree plantings and limits as shown in stage 2 erosion control plan details. Final location of trees is to be coordinated with Waukesha County DPW prior to planting.

If contractor constructs final driveways surfaces and/or base prior to structure construction completion they assume all maintenance and responsibility for damage to driveway due to construction activities.

Contractor is to coordinate all construction activities and equipment storage with Waukesha County DPW to not impact Waukesha County operations.

Contractor to notify Waukesha County Airport, Waukesha County Sherriff's office, and Waukesha County DPW 10 days prior to the start of construction.

5. Utilities.

The provisions of administrative rule TRANS 220 apply to this project.

Utility adjustments are not anticipated for this construction project. Coordinate construction activities with a call to Diggers Hotline or a direct call to the utilities that have facilities in the area as required per statutes. Use caution to ensure the integrity of underground facilities and maintain code clearances from overhead facilities at all times.

Contact the local governing road authority to find out if there are any locally owned facilities within the project limits.

Contact each utility company listed in the plans, prior to preparing bids, to obtain current information on the status of existing and any new utility relocation work.

All contractor utility installations are to be coordinated with the utility.
107-SER6 (20101021)

6. Holiday Work Restrictions.

Do not perform work on, nor haul materials of any kind along or across any portion of the highway carrying IH 94 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, August 31, 2018 to 6:00 AM Tuesday, September 4, 2018 for Labor Day;
- From noon Wednesday, November 21, 2018 to 6:00 AM Monday, November 26, 2018 for Thanksgiving;
- From noon Friday, December 21, 2018 to 6:00 AM Wednesday, January 2, 2019 for Christmas and New Year's Day;
- From noon Sunday, January 20, 2019 to 6:00 AM Tuesday, January 22, 2019 for Martin Luther King Jr. Day;
- From noon Friday, May 24, 2019 to 6:00 AM Tuesday, May 28, 2019 for Memorial Day.

stp-107-005 (20050502)

7. Erosion Control.

Supplement standard spec 107.20 with the following:

Erosion control best management practices (BMP's) shown on the plans are at suggested locations. The actual locations shall be determined by the contractor's ECIP and by the engineer. Include dust control and each dewatering or by-pass (mechanical pumping) operation in the ECIP submittal. The ECIP shall supplement information shown on the plans and not reproduce it. The ECIP shall identify how to implement the project's erosion control plan. ECIP shall demonstrate timely and diligently staged operations, continuing all construction operations methodically from the initial removals and topsoil stripping operations through the subsequent grading, paving, re-application of top soil, and restoration of permanent vegetation to minimize the period of exposure to possible erosion.

Provide the ECIP 14 days prior to the pre-construction meeting. Provide 1 copy of the ECIP to the department and 1 copy of the ECIP to the WDNR Liaison Craig Webster, (262) 574-2141, craig.webster@wisconsin.gov. Do not implement the ECIP without department approval and perform all work according to the approved ECIP.

Maintain Erosion Control BMP's until permanent vegetation is established or until the engineer determines that the BMP is no longer required.

Stockpile excess materials or spoils on upland areas away from wetlands, floodplains, and waterways. Immediately install perimeter silt fence protection around stockpiles. If stockpiled materials will be left for more than 14 days, install temporary seed and mulch, or other temporary erosion control measures the engineer orders.

Re-apply topsoil on graded areas, as designated by the engineer, immediately after the grading is completed within those areas. Seed, fertilize, and mulch/erosion mat top-soiled areas, as designated by the engineer, within 5 days after placement of topsoil. If graded areas are left not completed and exposed for more than 14 days, seed those areas with temporary seed and mulch.

To maintain the integrity of the sand forebay and dry pond, the contractor shall fully restore all disturbed areas draining to the pond prior to the construction of the pond. If the pond is constructed prior to restoration of disturbed areas, then additional erosion control BMP's will be required, and will be incidental to pond construction. This shall be identified in the pre-construction ECIP.

Dewatering (Mechanical Pumping) for Bypass Water (sediment-free) Operations
If dewatering bypass operations are required from one pipe structure to another downstream pipe structure or from the upstream to downstream end of a culvert and the bypass flow is not transporting sediments (sand, silt, and clay particles) from a tributary work site area, bypass pumping operations will be allowed provided that the department has been made aware of and approves operation. When pumping bypass flows, the discharge location will need to be stable and not produce any erosion from the discharge velocity that would cause release of sediment downstream. Dewatering is considered incidental to the contract.

Dewatering (Mechanical Pumping) for Treatment Water (sediment-laden) Operations
If dewatering operations require pumping of water containing sediments (sand, silt, and clay particles), the discharge will not be allowed to leave the work site or discharge to a storm water conveyance system without sediment removal treatment. Do not allow any excavation for; structures, utilities, grading, maintaining drainage that requires dewatering (mechanical pumping) of water containing sediments (sand, silt, and clay particles) to leave the work site or discharge to a storm water conveyance system without sediment removal treatment.

Prior to each dewatering operation, submit to the department a separate ECIP amendment for sediment removal. Guidance on dewatering can be found on the Wisconsin DNR website located in the Storm Water Construction Technical Standards, Dewatering Code #1061, http://dnr.wi.gov/topic/stormwater/standards/const_standards.html. Include reasoning, location, and schedule duration proposed for each operation. Per Code 1061, include all selection criteria: site assessment, dewatering practice selection, calculations, plans, specifications, operations, maintenance, and location of proposed treated water discharge. Provide a stabilized discharge area. If directing discharge towards or into an inlet structure, provide additional inlet protection for back-up protection. Dewatering is considered incidental to the contract.

Maintaining Drainage
Maintain drainage at and through worksite during construction according to standard spec 107.20, 204.3.2.1(3), 205.3.3 and 520.3.1(2). Use existing storm sewers, existing culvert pipes, existing drainage channels, temporary culvert pipes, or temporary drainage channels to maintain existing surface and pipe drainage. Pumps may be required to drain the surface,

pipe, and structure discharges during construction. Costs for furnishing, operating, and maintaining the pumps is considered incidental to the contract.
SER-107.3 (20161220)

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

The department has obtained a U.S. Army Corps of Engineers Section 404 permit. Comply with the requirements of the permit in addition to requirements of the special provisions. A copy of the permit is available from the regional office by contacting Win Ly at (262) 548-8739.
stp-107-054 (20080901)

9. Excavation Common Disposal of Excess Materials.

Waukesha County DPW is interested in retaining excess excavation materials on the county site. Waukesha County location and exact placement of material shall be coordinated between the contractor and the Waukesha County DPW / Highway Operations Manager at (262) 548-7736.

10. 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 and paid for under the Aggregate Detours, 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.
http://wisconsindot.gov/rdwy/cmm/cm-08-00toc.pdf

A.2 Small Quantities

(1) The department defines a small quantity, for each individual Base Aggregate bid item, as a contract 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:

A.2.1 Quality Control Plan

(1) Submit an abbreviated quality control plan consisting of the following:

1. Organizational chart including names, telephone numbers, current certifications with HTCP numbers, and expiration dates, and roles and responsibilities of all persons involved in the quality control program for material under affected bid items.

A.2.2 Contractor Testing

1. Testing frequency:

PART 1 - Contract Quantity	**PART 2 - Minimum Required Testing per source**
PART 3 - ≤ 6000 tons	PART 4 - One stockpile test before placement, and two production or one loadout test. *[1] [2]*
PART 5 - > 6000 tons and ≤ 9000 tons	PART 6 - One stockpile and Three placement tests *[3] [4] [5]*

[1] Submit production test results to the engineer for review before incorporating the material into the work. Production test results are valid for a period of 3 years.

[2] If the actual quantity overruns 6,000 tons, on the next day of placement perform one randomly selected placement test for each 3000 tons, or fraction of 3000 tons, of overrun.

[3] If the actual quantity overruns 9000 tons, on the next day of placement perform one randomly selected placement test for each 3000 tons, or fraction of 3000 tons, of overrun.

[4] For 3-inch material or lift thickness of 3 inch or less, obtain samples at load-out.

[5] Divide the aggregate into uniformly sized sublots for testing.

2. Stockpile testing for concrete pavement recycled in place will be sampled on the first day of production.

3. Until a four point running average is established, individual placement tests will be used for acceptance. 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. Material represented by a sublot 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.

A.2.3 Department Testing

(1) The department will perform testing as specified in B.8 except as follows:

Department testing may be waived for contract bid item quantities of 500 tons or less.

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:

SAMPLING AND TESTING ROLES	TEST STANDARD	REQUIRED CERTIFICATION
Random Sampling of Materials Sampling Aggregates	ASTM D3665 AASHTO T2 [1]	Transportation Materials Sampling Technician (TMS) Aggregate Technician I (AGGTEC-I) AGGTEC-I Assistant Certified Technician (ACT-AGG)
Percent passing the 200 Sieve Gradation Moisture Content Fractured Faces	AASHTO T11 AASHTO T27 AASHTO T255 ASTM D5821	Aggregate Technician I (AGGTEC-I) AGGTEC-I Assistant Certified Technician (ACT-AGG)
Liquid and Plasticity Index	AASHTO T89 AASHTO T90	Aggregate Testing for Transportation Systems (ATTS) Grading Technician I (GRADINGTEC-1) Grading Assistant Certified Technician (ACT-Grading)
Plasticity Check	AASHTO T90	Aggregate Technician I (AGGTEC-I) AGGTEC-I Assistant Certified Technician (ACT-AGG) Grading Technician I (GRADINGTEC-1) Grading Assistant Certified Technician (ACT-Grading)

[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-rsrces/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 one business day after obtaining a sample. 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 one business day after obtaining a sample. 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 placement tests, include only QC placement 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) Perform one stockpile test from each source before placement. One stockpile test may be used for multiple projects up to 60 calendar days.

(3) Test gradation once per 3000 tons of material placed or fraction thereof. 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 watering and compacting; except collect 3-inch samples or lift thickness of 3 inch or less 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.

(4) Split each contractor QC sample and identify it according to CMM 8.30. Retain the split for seven calendar days in a dry, protected location. If requested for department comparison testing, deliver the split to the engineer within one business day.

(5) The engineer may require additional sampling and testing to evaluate suspect material or the technician’s sampling and testing procedures.

(6) 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.
(7) 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 four 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 four 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. Perform one stockpile test from each source before 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 watering and compacting; except, for 3-inch aggregates or for a lift thickness of 3 inch or less, the department will collect samples 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 according to CMM 8-10.5.2 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.

stp-301-010 (20171130)

11. Cover Plates Temporary, Item 611.8120.S.

A Description
This special provision describes providing and removing steel plates to cover and support asphaltic pavement and traffic loading at manholes, inlets and similar structures during milling and paving operations.

B Materials
Provide a 0.25 inch minimum thickness steel plate that extends to the outside edge of the existing masonry.

C (Vacant)

D Measurement
The department will measure Cover Plates Temporary as each individual 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
611.8120.S	Cover Plates Temporary	EACH

Payment is full compensation for furnishing, installing, and removing the cover plates.
The steel plates shall become the property of the contractor when no longer needed in the contract work.
stp-611-006 (20151210)

12. Furnishing and Planting Plant Materials.

Conform to standard spec 632.

Delete standard spec 632.3.18 and 632.3.19 in their entirety.

Replace standard spec 632.3.20(1) with the following:

Once planted, mulched, and fertilized, the engineer will make final inspection of the planting and approve only those plants in a healthy growing condition and conforming to the following minimum requirements:

- Plant sizes and standards shall adhere to the American Standards for Nursery Stock.
- All plants are the species specified unless the engineer approves changes. Conform to standard spec 632.3.19, for proper care of plants.
- Deciduous trees shall exceed the minimum size of the specified size range and shall have fully matured, average-sized, healthy leaves distributed throughout the branch system as is typical of the species.

- Deciduous shrubs shall exceed the requirements of the specified size range and have mature, average-sized leaves typically distributed throughout the branch system.
- Deciduous vines shall have the required number of runners, each exceeding the minimum required length.
- Evergreens shall exceed the minimum size of the specified size range and all coniferous types shall have fully developed, mature needles, and average-sized buds on current season's growth.

Replace standard spec 632.5.2 (1) with the following:

The department will pay the contract value of the work each time an item or portion of an item is acceptably completed.

13. Pond Liner Clay, Item 640.1303.S.

A Description

This special provision describes furnishing and installing low permeable clay in the areas shown on the plans.

B Materials

For each source, prior to excavating and hauling the low permeable clay to the project, submit the results of the laboratory tests described in Table 1. The laboratory testing shall document that the clay from the source meets or exceeds the requirements.

The sample for the hydraulic conductivity test shall be remolded clay at a minimum dry density of 95% of the maximum dry density as determined by the Standard Proctor test AASHTO T-99 and at a moisture content required to achieve the required hydraulic conductivity, but with a minimum moisture content at or above the optimum moisture content as determined in the Standard Proctor test AASHTO T-99. Conduct the laboratory source testing at the frequency listed in Table 1. Submit the test results to the engineer for review, two weeks prior to construction.

C Construction

C.1 Low Permeable Clay Placement

C.1.1 Subgrade

Compact the subgrade to a minimum density as defined in standard spec 207.3.6.2, Standard Compaction, or as otherwise specified in the contract requirements.

C.1.2 Erosion Protection

Do not place the low permeable clay until after all adjacent site grading has been completed and only after silt fence has been installed completely around the area of low permeable clay placement.

C.1.3 Low Permeable Clay Placement

After the fine grading is complete, place and compact low permeable clay in completed 6-inch lifts. Place each lift of low permeable clay in one continuous lift. See plans for low

permeable clay construction limits. Measure the thickness of the low permeable clay shown on the plans perpendicular to the surface.

Notify the engineer at least three days prior to starting construction of low permeable clay.

Table 1

Reference	Number	Test Title	Requirements	Testing Frequency	
				Screening	QA/QC[12]
AASHTO[1]	T99-01	Moisture –Density Relationships of Soils Using a 2.5-kg (5.5 lb) Rammer a 305 mm (12-in.) Drop (Standard Proctor)	NA[11]	1/source	NA
AASHTO	T-88-00	Particle Size Analysis of Soils	P200[3] $\geq$ 50%	2/source	1/lift
AASHTO	T-89-02	Determining the Liquid Limit of Soils	LL[4] $\geq$ 22%	2/source	1/lift
AASHTO	T-90-00	Determining the Plastic Limit and Plasticity Index of Soils	PI[5] $\geq$ 12%	2/source	1/lift
AASHTO	T310-03	In-Place Density and Moisture Content of Soils and Soil-Aggregates by nuclear Methods (Shallow Depth)	DD[6] $\geq$ 95% of the MDD[7]	NA	100'x100' Grid/lift
ASTM[2]	D5084-03	Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	K[8] $\leq 1 \times 10^{-7}$ cm/sec	1/source[9]	1/site[10]

Notes:

1. AASHTO = American Association of State Highway and Transportation Officials
2. ASTM = American Society of Testing and Materials
3. P200 = Percent by weight passing the #200 sieve (%)
4. LL = Liquid Limit (%)
5. PI = Plasticity Index (%)
6. DD = Dry Density (pcf)
7. MDD = Maximum Dry Density (pcf) as determined by the Standard Proctor Test
8. K = Hydraulic Conductivity (cm/sec)

9. The sample for the test shall be remolded at a minimum dry density of 95% of the maximum dry density as determined by the Standard Proctor test and at a moisture content required to achieve the required hydraulic conductivity, but with a minimum moisture content at or above the optimum moisture content as determined in the Standard Proctor test.
10. An undisturbed sample from a thinned walled sampler (Shelby tube)
11. NA = Not applicable
12. QA/QC = Quality Assurance / Quality Control

Compact the low permeable clay to a minimum of 95% Standard Proctor AASHTO T-99 Maximum Dry Density with a footed compaction equipment having feet at least as long as the loose lift height. As needed, clay shall be disked or otherwise mechanically processed prior to compaction to break up clods and allow moisture content adjustment. Clod size shall be no greater than 4-inches. All compaction equipment utilized shall have a minimum static weight of 30,000 pounds.

Provide all equipment necessary to adjust low permeable clay to the proper moisture content for compaction.

Make sufficient number of passes of the compaction equipment over each lift of clay to ensure complete remolding of the clay.

Do not proceed with placement of additional lifts until all required low permeable clay testing and documentation has been completed for the previous lift.

During placement of the low permeable clay the minimum moisture content shall be as defined by the testing performed in the source evaluation and with the following limits:

- No drier than the optimum moisture content as determined by the Standard Proctor test.

If the in-place low permeable clay fails to meet the requirements of Table 1, then remove and replace or rework any portion of the low permeable clay not meeting the project requirements until project specifications are met. There shall be no compensation for removing, replacing and reworking low permeable clay not meeting the requirements in Table 1.

C.1.4 QA/QC Testing of the Low Permeable Clay

The department will perform the QA/QC testing at the frequency shown in Table 1. The department will record the thickness of low permeable clay on a 100-foot x 100-foot grid pattern.

Provide the following:

- Access for on-site testing, inspection, and documentation.
- Machinery required to grade/blade density test locations.
- Machinery required to collect undisturbed clay samples (i.e., with Shelby tubes).

- Replace and recompact clay material removed for testing purposes.

D Measurement
The department will measure Pond Liner Clay in volume by the cubic yards, 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
640.1303.S	Pond Liner Clay	CY

Payment is full compensation for dewatering areas of site where the low permeable clay is to be placed; for furnishing, placing and compacting the low permeable clay; and for performing all tests.
stp-640-016 (20130615)

14. Pea Gravel, Item SPV.0035.01.

A Description
This special provision describes furnishing and placing Pea Gravel within detention pond as shown in plans.

B Materials
Furnish round, washed, pea gravel that does not contain any fine materials. Material shall be approved by onsite engineer prior to delivery or placement.

C Construction
Place pea gravel as shown in plans.

D Measurement
The department will measure Pea Gravel by the cubic yard, placed, and 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.0035.01	Pea Gravel	CY

Payment is full compensation for supplying and placement of Pea Gravel to include equipment, labor, tools, and incidentals necessary to complete the work.

15. Natural Gas Service, Item SPV.0055.01.

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 Brining Building.

B (Vacant)

C Construction
Contractor shall make all arrangements and coordinate gas utility work with We Energies.

Utility will provide gas service to the new Brining Building.

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 item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0055.01	Natural Gas Service	DOL

Payment is full compensation for providing underground gas service from tie-in at existing to new Brining 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.

16. Static Scale System, SPV.0105.01.

A Description
This special provision describes furnishing and installing a fully electronic, concrete deck above-ground installation type, commercial motor vehicle scale with a minimum weighing platform for the purpose of weighing loaded plow and quad axle trucks. The scale shall be furnished and installed complete as specified as follows, including weighbridge, foundation, platform reinforcing, pit coping, load cells, indicators, surge voltage protection system and the services of the manufacturer's service representative. Equipment shall be designed to function in an extreme cold and corrosive environment.

Exact, final location of scale to be coordinated and verified with Waukesha County Operations prior to any work being performed.

Equipment furnished and installed shall be assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by the engineer.

Scale and components shall have been issued a Certificate of Conformance (COC) by the National Type Evaluation program (NTEP) and shall meet the requirements set forth by the National Institute of Standards and Technology (NIST), Handbook 44, “Specifications, Tolerances, and Technical Requirements for Weighing and Measuring Devices”. The following specifications represent the minimum static scale requirements.

B Materials

B.1 The Static Scale

Furnish and install one concrete deck above-ground truck scale with a minimum gross capacity of 75 tons (150,000 lbs.) and a minimum weighing platform of 40’ x 10’ wide. Equipment to consist of parts designed to act as a unit by a manufacturer that has a minimum of five years of experience in design, construction, and operation of equipment for the purpose required.

The platform shall have 24 inch manholes located to facilitate future maintenance.

B.2 Load Cells

The weighing elements shall be stainless steel, hermetically sealed load cells to guard against moisture ingression and barometric effects. Load cells shall be designed to allow for routine cleaning and maintenance without damage to the cell. Load shall be applied to the cells without the use of links, bolts, pins cables or flexure. The scale shall have self-diagnostic capabilities able to identify load cell problems and failure.

B.3 Concrete Deck Above-Ground Scale

The dimensions for the scale foundation and platform for a concrete deck above-ground scale shall be as recommended by the equipment manufacturer and accepted by the engineer. Reinforcing steel placement and structural steel embedment placement shall be performed as shown on the manufacturer’s foundation drawings.

B.4 Driver Interface Terminal

Drivers will interact with the Driver Interface terminal in one of two ways. Internal users will have an RFID unit and external customers will not.

Furnish and install one driver interface terminal. Equipment to consist of parts desired to act as a unit by a manufacturer experienced in design, construction, and manufacture of electronic components, and operation of equipment for the purpose required. The driver interface terminal shall be designed to be an unattended system. The display shall be a full graphic, alphanumeric LED back-lit display with the capability to prompt the operator through all operations with true alpha characters. Segmented LED alphanumeric displays are not acceptable.

Terminal location shall be field fit to meet the purpose of the device. Driver’s operating the scale must be able to operate all functions of the driver interface terminal and collect the paper tickets without exiting the vehicle. The terminal shall be placed to promote proper positioning of the vehicle on the scale. The driver interface terminal must have a manual touch keyboard or touch screen. The terminal prompts and input data shall be fully

customizable by the owner. The terminal shall have the availability to print a paper ticket upon completion of the user interaction/weighing process. The data printed on the ticket must be fully customizable by the owner to include, but not limited to items such as:

1. Department/unit
2. Site location and ID
3. Date and time
4. Title (Static scale weights: Report)
5. Total gross weight
6. Tare weight
7. Net weight
8. Truck number

The scale system shall include an electronic vehicle identification system through RFID. Supply 125 RFID modules for use by internal customers. The scale system shall be customizable and have the capability to store the following information related to the RFID system:

- Department
- Truck Number
- Truck Tare
- Driver Name

B.5 Static Scale Operation Specifications

The scale system must have the ability to retain all saved data in the event of power loss. All settings and saved data must be retained.

The system must contain a real-time clock with 12 hour AM/PM and 24-hour, month/day/year date format. Two or four digit year date selectable.

The scale instrument shall be capable of being programmed and calibrated in pounds, tons or kilograms.

The system must be able to store tare weights and associate them with truck numbers.

B.6 Remote Interface

The system shall have the capability to send information wirelessly from the scale, and its components, to a remote location. Information must be able to be sorted, searched, tabulated, and put into a printable report form. The owner must be able to customize the information. The information sent to the remote location shall consist of, but not limited to:

1. Department/unit
2. Site location and ID
3. Date and time
4. Title (Static scale weights: Report)
5. Total gross weight
6. Tare weight
7. Net weight
8. Truck number

B.7 Remote Display Requirements
Supply one remote display and all poles and mounting hardware. The remote display shall be hard-wired to the scale. The remote display must have the capacity to display the anticipated weight values. The display shall be of fluorescent yellow or red in color, and be visible at night and low visibility situations.

Supply one traffic light at the remote display location to assist the driver with stopping and leaving the scale. A red light shall appear to the driver during the weighing process and a green light shall appear to the driver when weighing is complete. The traffic light must be visible at night and low visibility situations. The traffic light may be incorporated into the remote display described in other sections of this specification.

B.8 Electrical Requirements
The truck scale components (load cells, driver interface terminal, vehicle identification system, remote interface, remote display, and lightning protection system) shall all be interconnected to operate as a complete system for connection to a single 120 VAC, single phase power source. Electrical work shall meet or exceed NEC requirements.

All junction boxes shall be stainless steel, NEMA 4X (IP65) rated. Junction boxes shall be accessible for inspection and maintenance.

All wiring shall be installed in conduit. Conduit shall be galvanized rigid steel. Flexible connections shall be made using liquidtight flexible metal conduit (LFMC) with approved fittings.

B.9 Lightning Protection Specifications
A comprehensive lightning protection system shall be provided with the scale. Static scale system shall have been tested and passed lightning simulated lightning strike up to 80,000 amperes. The system shall not require complicated wiring or devices to provide this protection. Major scale components including load cells and scale instrument shall be included in the lightning protection system. Verification of lightning protection system performance shall be available in writing from the manufacturer upon request. Electrical diagrams of the scale grounding and surge protection shall be supplied with submittals. The surge voltage package shall be provided as a unit and be tested and approved by the scale manufacturer.

C Construction
C.1 Submittals
Submit complete foundation and installation drawings, together with detailed specifications and data covering materials, parts, devices and accessories. Drawings shall cover all scale components, foundation details, and pier loading information necessary for the design of the scale foundation or installation. Submit any relevant manufacturer information, including user manuals, instructions and warranty information. Submit any required certifications and testing documentation.

C.2 Training
Upon completion, an experienced, competent, and authorized representative of the manufacturer shall set up and conduct training for WisDOT and Waukesha County personnel on the operation, maintenance, calibration, installation and repair of the equipment specified under this specification.

D Measurement
The department will measure Static Scale System, completed according to the contract and accepted, as a single complete lump sum unit of work.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.01	Static Scale System	LS

Payment is full compensation for sawing pavement, removing all pavement, any excavation required, pavement replacement, landscaping items, furnishing and installing all materials; coordinating and making all utility hook-ups; making the system operational; calibrating; testing and providing required training.

17. Underground Detention Wastewater Tank, 10-FT Diameter, Item SPV.0105.02.

A Description
This special provision describes providing and installing a 10’ diameter, 30,000 gallon fiberglass underground detention wastewater tank that is salt resistant, with one 36-inch manway structure with hinged and lockable manway extension, access ladder, one 30-inch access structure with required risers and lockable cover, deadmen, straps, and connection to 12-inch storm sewer pipe.

B Materials

UNDERGROUND DETENTION WASTEWATER TANK
A. Tank Design - Fiberglass reinforced plastic (FRP) tanks:
   1. The tank size, fittings and accessories shall be as shown on the drawings.
   2. Tank shall be manufactured with structural ribs which are fabricated as in integral part of the tank wall.
   3. Tank shall be manufactured with a laminate consisting of resin and glass fiber reinforcement only. No sand/silica fillers or resin extenders shall be used.
   4. Tank shall be vented to atmospheric pressure.
   5. Tank shall be compatible with liquids identified in the manufacturer's standard limited warranty.

B. Loading Conditions - Tank shall meet the following design criteria:
   1. Internal Load - Tank shall be designed to withstand a 5-psig (35 kPa) air-pressure test with a 5:1 safety factor.
   2. Surface Loads - Tank shall be designed to withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current Installation Manual and Operating Guidelines.
   3. External Hydrostatic Pressure - Tank shall be designed for 7 feet (2.1 m) of overburden over the top of the tank, the hole fully flooded, and a safety factor of 5:1 against general buckling.
   4. Tank Design: Single-Wall or Double-Wall vessel as specified and shown on the Drawings.

C. Tank Accessories
   a. Tank Anchoring:
   1) Anchor straps shall be as supplied by tank manufacturer and designed for a maximum load of 25,000 lbs (11340 kg).
   2) Galvanized turnbuckles shall be supplied by the tank manufacturer.
   3) Prefabricated concrete anchors shall be supplied by the tank manufacturer, designed to the ACI 318 standard, manufactured with 4,000 psi concrete and shall have adjustable anchor points.
   b. Access Openings:
   1) All access openings shall have a diameter of 30 inches, complete with riser, lockable lid and necessary hardware.
   c. Attached Access Risers:
   1) Attached access risers shall be PVC or FRP as supplied by tank manufacturer.
   2) Attached access risers shall be 30 inches diameter.
   3) Access risers shall be attached to access openings during installation utilizing adhesive or FRP bonding kits as supplied by the tank manufacturer.
   d. Piping and Fittings:
   1) Tank shall be equipped with factory-installed threaded fittings, or pipe stubs.
   2) PVC piping shall at a minimum meet the requirements of ANSI Schedule 40.
   3) All flanged nozzles shall be flanged and flat-faced, and conform to Class 150 bolting patterns as specified in ANSI/ASME/ B16.5.
   4) Carbon steel and stainless steel NPT fittings shall withstand a minimum of 150 foot-pounds (203 NM) of torque and 1,000 foot-pounds (1356 NM) of bending, both with a 2:1 safety factor.
   e. Manway Openings:
   1) The standard manway shall be flanged, 36 inches I.D. and complete with gaskets, bolts, and have a hinged and lockable manway extension.
   2) Manway openings shall be designed to withstand 5-psig (35 kPa) test pressure with a 5:1 safety factor.
   f. Ladders: Ladders shall be the standard FRP ladder as supplied by tank manufacturer.

C Construction

SUBMITTALS

PRODUCT DATA:
Submit manufacturer's data sheets on each product to be used, including, but not limited to, the following:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation manual and operating guidelines.

SHOP DRAWINGS:
Tank manufacturer shall submit the following for review and approval prior to fabrication of the tanks:

1. Detailed shop drawings of each tank complete with all accessories supplied by the manufacturer.
2. Detailed shipping, handling and installation instructions.

QUALITY ASSURANCE

1. Tank installations in the United States:
   Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction.

DELIVERY, STORAGE, AND HANDLING
General: Comply with tank manufacturer's Installation and Operating Guidelines recommendations for delivery, storage, and tank handling.

WARRANTY
Warranty: Provide manufacturer's standard limited warranty.

INSTALLATION

1. Includes all required excavation, base materials, requirements of installation based on soil type and ground water elevation, placement, and installation of all required materials including inside the tank items.

D Measurement
The department will measure Underground Detention Wastewater Tank, 10-FT Diameter, completed according to the contract and accepted, as a single complete lump sum unit of work.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.02	Underground Detention Wastewater Tank, 10-FT Diameter	LS

Payment is full compensation for all design requirements, material delivery, required excavation and disposal of material, base materials / fill and compaction, requirements of installation based on soil type and ground water elevation, placement, and installation of all required materials including inside the tank required items. Any temporary landscaping items will also be included in this item.

18. General Requirements for Building Construction.

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

Item SPV.0105.03, Brining Building General Construction
Item SPV.0105.04, Brining Building Plumbing
Item SPV.0105.05, Brining Building Heating and Ventilation
Item SPV.0105.06, Brining Building Electrical
Item SPV.0105.07, Salt Storage Shed

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
01110 Summary of Work
01330 Submittal Procedures
01455 Testing Laboratory Services
01740 Cleaning
01789 Project Record Documents

SECTION 01110 – SUMMARY OF WORK

PART 1 – GENERAL

1.01 SUMMARY

A. The Work of this Contract is generally described as general construction of brining building and salt storage shed including structural, architectural, plumbing, heating, ventilation, and electrical.

1.02 WORK BY OTHERS

A. Work on Site which will be executed after start of Work on this Contract and may be concurrent to this Contract, but is excluded from this Contract:

1. Installation of equipment, storage tanks, piping, control panels, truck loadout and all ancillary items required for the brining process.

1.03 CONTRACTOR'S USE OF PREMISES

A. Conduct operations to ensure least inconvenience to owner and operation of existing facility. Cooperate with owner during construction operations to minimize conflict and to facilitate owner's operations.

B. When keys to locked areas are needed to provide access to areas to perform Work, obtain from owner. Return keys at end of day's Work.

C. Employees of contractor and Subcontractors involved in Work shall wear identifying button or badge when working in facilities occupied by owner.

D. Obtain and pay for use of additional storage or Work areas needed for operations at no additional cost to owner.

1.04 OWNER FURNISHED MATERIALS OR EQUIPMENT

A. Owner will furnish the following materials or equipment:

1. All brining process related equipment, piping, storage tanks, and controls.

B. Owner's Responsibilities:

1. Deliver Shop Drawings, product data, and samples to contractor.
2. Deliver Supplier's bill of materials to contractor.
3. Arrange for manufacturer's warranties, bonds, service, and inspections as required.
4. Arrange for delivery of materials and equipment.

C. Contractor's Responsibilities:

1. Designate delivery and installation dates for materials and equipment in construction progress schedule.
2. Review Shop Drawings, product data, and samples.

    a. Submit to owner a list of discrepancies or problems anticipated in use of material or equipment.

3. Handle material and equipment at site, including unloading at site according to manufacturer's instructions.
4. Inspect material and equipment jointly with owner, record shortages and damaged or defective items.
5. Protect material and equipment from exposure to the elements, and from damage.
6. Assemble, install, connect, adjust, finish, and test according to manufacturer's written instructions and Contract Documents.
7. Repair or replace items damaged by contractor.

1.05 OWNER OCCUPANCY OF PREMISES

A. Owner will occupy site and existing facilities during entire construction period for conduct of normal operations.

B. Owner reserves right to partially occupy and to place and install equipment in completed areas of facilities, prior to Substantial Completion, provided that such occupancy does not interfere with completion of Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the Work.

C. Prior to partial owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon partial occupancy, owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the facility.

D. Partial occupancy shall conform to requirements of General Conditions.

1.06 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 01330 – SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Requirements for Work-related submittals including shop drawings, product data, samples, test results, operating and maintenance data, and other miscellaneous Work-related submittals.

1. Submittals for record drawings are specified in Section 01789.

B. Work–Related Submittals:

1. Shop Drawings:

a. Includes technical data and drawings specifically prepared for this Project, including fabrication and installation drawings, diagrams, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.

2. Product Data:

a. Includes standard catalog type printed information on manufactured materials, equipment and systems that has not been specifically prepared for this Project, including manufactures' product specifications, catalog cut sheets, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.

3. Samples:

a. Includes fabricated and manufactured physical examples of materials, products, and units of Work, including complete units, partial cuts of manufactured or fabricated Work, swatches showing color, texture, and pattern, and units of Work to be used for independent inspection and testing.
b. Mock-ups are special forms of Samples too large or otherwise inconvenient for handling in manner specified for transmittal of Sample submittals.

4. Test Results:

a. Includes source and field quality inspection and test reports, actual performance curves, and certifications of results prepared specifically for equipment, material, and systems provided for this Project.

5. Operating and Maintenance Data:

    a. Includes information and directions for operating and maintaining equipment provided and installed for this Project. May be standard for equipment or prepared specifically for this Project.

6. Miscellaneous Submittals:

    a. Work-related submittals that do not fit in previous categories, including schedules, guarantees, warranties, certifications, maintenance agreements, workmanship bonds, survey data and reports, physical work records, copies of industry standards, field measurements, extra materials, keys, and similar information, devices, and materials applicable to Work.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Scheduling:

1. Provide preliminary and final schedule of submittals indicating time requirements for coordination of submittals with performance of Work.
2. Adjust schedule of submittals to reflect revisions to Progress Schedule.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of Work. Coordinate each submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery, and similar activities.
2. Coordinate submission of different units of interrelated Work so submittal will not be delayed by engineer's need to review related submittal. Engineer may withhold action on submittal requiring coordination with other submittals until related submittals are provided.
3. Prepare and transmit each submittal sufficiently in advance of scheduled performance of related Work and other applicable activities.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review and approval of submittal, verification of material and equipment, field measurements, field construction criteria, and coordination of information with Contract Documents.

2. Transmittal Form shall identify the following:

    a. Date
    b. Transmittal and Submittal number
    c. Project
    d. Name and signature of contractor:
    e. Specification section and/or Drawing numbers.
    f. Description of submittal (i.e. equipment identification numbers, motor numbers, etc.)
    g. Variations from Contract Documents

D. Resubmittal Preparation:

1. Comply with requirements for Submittal Preparation above, and in addition:

    a. Identify on transmittal form submittal is a resubmission.
    b. Make corrections or changes in submittal required by engineer's notations on returned submittal.
    c. On transmittal or separate page, answer or acknowledge in writing notations or questions indicated on engineer's transmittal form of returned submittal.

        1) Identify each response by question or notation number established by engineer.
        2) If contractor does not respond to each notation or question, resubmission will be returned without action by engineer until contractor provides written response.

    d. Contractor-initiated revisions or variations:

        1) On transmittal form, identify variations or revisions from previously reviewed submittal.

3.02 SPECIFIC SUBMITTAL REQUIREMENTS

A. General:

1. Comply with requirements specified below for each indicated type of submittal. Specific submittal requirements for individual units of work are specified in applicable Specification section.
2. If engineer has responded to Written Clarification/Interpretation/Request submitted by contractor, include engineer's response with submittal.

B. Shop Drawings:

1. Maximum size 22 in. by 34 in.
2. Submit graphic information at accurate scale with name of preparer indicated.
3. Show dimensions and note which are based on field measurements.
4. Indicate compliance with standards and notation of coordination requirements.
5. Highlight, encircle or otherwise indicate variation from Contract documents or previous submittals and revisions on resubmittals.
6. Do not use engineer's Drawings as Shop Drawings.
7. Provide blank space for contractor stamps.
8. Provide 4-in. by 8-in. blank space for engineer stamps.
9. Submit 6 copies. Contractor may provide shop drawings electronically for engineer review.

C. Product Data:

1. Collect required data into single submittal for each unit of Work or system. Where product data includes information on several similar materials or equipment, some of which are not require for use in Project, mark copies to show which items are not applicable to Project.
2. Submit 6 copies. Contractor may provide product data electronically for engineer review.

D. Samples:

1. Provide Samples physically identical with proposed materials and equipment to be incorporated into work. Where variations in color, pattern, and texture are inherent in product, submit multiple units (not less than 3) showing approximate limit of variations.
2. Provide full set of option Samples where selection by owner or engineer is required.
3. Include information with Sample to show generic description, source, product name, manufacturer, limitations, and compliance with standards.
4. Submit Samples with other related elements of work.
5. Submit 3 sets of Samples where Specifications indicate engineer's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. For other submittals, submit a single set of Samples. One set of Samples will be returned with engineer's action noted.
6. Maintain returned set of Samples at Project site, in suitable condition and available for quality control comparisons throughout course of Work.

E. Test Results:

1. Identify each test by Specification section and type of test.
2. Submittal is to confirm that results of tests verify materials, products, and systems comply with Contract Documents and are not for approval.

3. Unless otherwise required in Specifications, test results shall be submitted to engineer's field office.
4. Submit 3 copies. Contractor may provide test results electronically for engineer review.

F. Operating and Maintenance (O&M) Data:

1. Organize operating and maintenance information into suitable sets of manageable size, and bind into individual binders properly identified and indexed. Include emergency instructions, spare parts list, copies of warranties, wiring diagrams, recommended "turn-around" cycles, inspection procedures, Shop Drawings, product data, and similar applicable information.
2. Binders shall be heavy duty 2-in., 3 ring, vinyl covered, with pocket folders for folded sheet material
3. Submit after equipment submittal has been returned "Approved" or "Approved as Noted".
4. Submit 2 copies.

G. Miscellaneous:

1. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:

    a. Refer to Specification sections for requirements.
    b. Provide 2 executed copies. Provide 2 additional copies where required for operation and maintenance data.

2. Survey Data:

    a. Refer to Specification sections for requirements of property surveys, building or structure condition surveys, field measurements, quantitative records of actual work, damage surveys, and similar data.
    b. Submit 10 copies of property surveys. Submit 2 copies of other surveys.

3. Certifications:

    a. Refer to Specification sections for requirements.
    b. Submit 6 copies.

4. Closeout Submittals;

    a. Refer to Specification sections for requirements of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar units to be submitted.

3.03 ACTION ON SUBMITTALS

A. General:

1. Except for submittals for record and similar purposes, where action and return is not required or requested, engineer will review each submittal, mark the appropriate action, and return.
2. Where submittal must be held for coordination, engineer will so advise contractor without delay.
3. Engineer will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Notification of Insufficient Information:

1. If information submitted is not sufficient to complete review of submittal, engineer will send transmittal to contractor notifying contractor that additional information is required.
2. Submittal will be placed “on hold” and not returned until contractor provides the additional information.

C. Unsolicited Submittals:

1. Engineer will return unsolicited submittals without reviewing.

D. Action Stamp:

1. Marking: “Approved”

    a. Work covered by submittal may proceed provided it complies with Contract Documents. Acceptance of Work depends on that compliance.

2. Marking: “Approved As Noted”

    a. Work covered by submittal may proceed provided it complies with engineer’s notations or corrections on submittal and with Contract Documents. Acceptance of work depends on that compliance. Resubmittal not required.

3. Marking: “Revise and Resubmit”

    a. Do not proceed with Work covered by submittal.
    b. Revise submittal or prepare new submittal according to engineer’s notations.

4. Marking: “Not Approved”

    a. Work covered by submittal does not comply with Contract Documents. Do not proceed with Work covered by submittal.
    b. Prepare new submittal complying with Contract Documents.

E. General Distribution:

1. Unless required elsewhere, provide distribution of submittals to Subcontractors, Suppliers, governing authorities, and others as necessary for performance of Work.
2. Provide copies of submittals bearing engineer’s action stamp to:

    a. Job site file.
    b. Record documents file.

SECTION 01455 – TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Testing and inspecting to be provided by the contractor.

B. Provide the services of a testing laboratory approved by owner.

C. Provide all tests and inspections required by governmental agencies having jurisdiction, and required by provisions of the Contract Documents.

D. All concrete testing incidental to the project will be tested per 716 class II ancillary.

E. Perform additional tests as required by engineer.

F. Perform additional inspections, sampling, and testing required when initial tests indicate Work does not comply with Contract Documents.

G. Specified inspections and/or tests may be waived only by the specific approval of engineer, and such waivers will result in credit to the owner equal to normal cost of such inspection and/or test.

1.02 PAYMENT

A. Include within the Contract Price an amount sufficient to cover all testing and inspecting required under this Section, and to cover all testing and inspecting required by governmental agencies.

B. The owner will pay for additional testing and inspecting specifically requested by the engineer when such tests indicate conformance with Contract Documents.

C. When additional tests requested by engineer, or initial tests, indicate noncompliance with the Contract Documents, all inspection, sampling, and testing and subsequent retesting occasioned by the noncompliance shall be performed by the testing laboratory and the costs thereof shall be paid by the contractor.

1.03 SUBMITTALS

A. Upon completion of each test and/or inspection, promptly submit written report of each test and inspection; one copy each to engineer, owner, material supplier, and contractor, and one copy to record documents file. Each report shall include following:

1. Date issued.
2. Project title and number.
3. Testing laboratory name, address, and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Temperature and weather conditions if test performed in field.
7. Date of test.
8. Identification of product and Specification section.
9. Location of sample or test in Project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by engineer.

1.04 QUALIFICATIONS OF LABORATORY

A. Meet requirements of ASTM E329.

B. Authorized to operate in state where Project located.

C. Testing equipment calibrated at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or other accepted values of natural physical constants.

PART 2 – PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 TAKING SPECIMENS AND TESTING

A. Except as may be specifically otherwise approved by engineer, testing laboratory shall secure and handle all samples and specimens for testing and conduct testing.

B. Comply with specified standards.

3.02 COOPERATION WITH TESTING LABORATORY

A. Provide access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

B. Notify laboratory sufficiently in advance of operations to allow laboratory assignment of personnel and scheduling of tests.

   1. When tests or inspections cannot be performed due to lack of such notice, reimburse owner for laboratory personnel, travel expenses, and cost of test normally incurred.

SECTION 01740 – CLEANING

PART 1 - GENERAL

1.01 SUMMARY

A. Perform cleaning throughout construction period and at completion of Work.

B. Refer to Specification sections for specific cleaning products or Work.

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

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

B. Use only those cleaning materials which will not create hazards to property and persons.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

A. Provide on-site containers for collection and removal of waste materials, debris, and rubbish according to applicable regulations.

B. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

3.02 FINAL CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing and mirrors.

C. Polish glossy surfaces to clear shine.

D. Ventilating Systems:

1. Clean permanent filters and replace disposable filters if units were operating during construction.
2. Clean ducts, blowers, and coils if units were operated without filters during construction.

E. Electrical Systems:

1. Leave electrical equipment rooms broom clean.
2. Clean interior of panel cabinets, pull boxes, and other equipment enclosures.
3. Clean lighting fixtures, lamps, and other electrical equipment soiled during installation.
4. Touch-up paint or repaint finishes on electrical items delivered to Project with finished coat of paint. Engineer will make final determination of items to be repainted or touched-up.

F. Broom clean interior hard surface floors and exterior paved surfaces. Rake clean other surfaces of grounds.

G. Clean out existing or new sewers to remove sediment and other materials that have entered during construction.

H. Clean roads and streets used as haul roads during construction of accumulated material. Clean paved streets with water.

I. Prior to Final Completion or owner occupancy, contractor, with engineer and owner, shall conduct inspection of exposed interior and exterior surfaces and work areas to verify Work and Site is clean.

3.03 CLEANING DURING OWNER'S OCCUPANCY

A. Should the owner occupy the Work or any portion thereof prior to its completion by the contractor and acceptance by the owner, responsibilities for interim and final cleaning shall be as determined by engineer.

SECTION 01789 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents.

B. Maintain at Site one record copy of:

1. Drawings.
2. Project Manual.
3. Addenda.
4. Change Orders and other modifications to Contract.
5. Engineer Field Orders, written instructions, or clarifications.
6. Approved Shop Drawings and other Work-related submittals.
7. Field modifications made to equipment by contractor, Subcontractors and Suppliers.
8. Field test records.
9. Construction photographs.
10. Associated permits.
11. Certificates of inspection and approvals.

1.02 SUBMITTALS

A. Prior to Substantial Completion, submit revised operation and maintenance data for field modifications made by contractor, Subcontractors, and Suppliers.

B. Prior to Substantial Completion, submit revised copies of approved Shop Drawings and other Work-related submittals for equipment modified in field by contractor, Subcontractors, and Suppliers.

C. Prior to submitting request for substantial completion, deliver one complete coordinated marked up set of Drawings to engineer for use in preparation of record drawings.

D. Prior to submitting request for final payment, submit the remaining Project Record Documents to engineer for owner.

E. Accompany submittals with transmittal letter containing following:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title of record document.
5. Signature of contractor or authorized representative.

PART 2 – PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and Samples in contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide secure storage space for storage of Samples.

B. Maintain documents in clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

C. Label each document "PROJECT RECORD" in neat, large letters.

D. Make documents and samples available for inspection by engineer and owner.

E. Failure to properly maintain record documents may be reason to delay a portion of progress payments until records comply with Contract Documents.

3.02 RECORD DRAWINGS

A. Maintain one record set of Drawings legibly annotated to show all changes made during construction and the final location of all underground piping and utilities.

1. The marked up set of Drawings shall be a compilation of all of the changes made by all of the trades involved. Individual sets from the various subcontractors will not be accepted.
2. The marked up set of Drawings shall graphically show the changes. Reference to RFI's, Change Orders, Field Orders, etc. will not be accepted.

3. The marked up set of Drawings shall incorporate changes made to the primary drawings, and shall include the corresponding changes made to the ancillary drawings.

B. Record information concurrently with construction progress.

C. Drawings:

1. Graphically depict changes by modifying or adding to plans, details, sections, elevations, or schedules.
2. Using a red colored pencil or pen, clearly describe the changes by graphic line and note as required. Provide supplemental photographs where required to clarify drawing mark up.
3. Note the following:
    a. Depths of various elements of foundation in relation to finished first floor elevation.
    b. Horizontal and vertical locations of underground cable, conduit, duct runs, underground utilities and appurtenances, and underground piping referenced to visible and accessible features. These features shall be located where they leave or enter any structure and at changes in horizontal or vertical direction. The invert elevation of piping and the top of conduit or duct banks shall be noted. GPS coordinates may be used.
    c. Field changes.
    d. Details not on original Drawings.
    e. Location and identification of exposed interior piping, including those shown schematically on Drawings.
    f. Location and size of equipment including connections.
    g. Departures from original Drawings.

19. Brining Building General Construction, Item SPV.0105.03.

A Description

This special provision describes providing the general construction required to complete the Brining Building 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 Brining Building General Construction by the lump sum completed according to the contract and accepted, as a single complete unit of work.

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	Brining Building General Construction	LS

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

INDEX OF GENERAL CONSTRUCTION SPECIFICATIONS

SECTION 02315 – EXCAVATION AND BACKFILL

PART 1 – GENERAL

1.01 SUMMARY

A. Excavation and backfilling for structures to elevations shown on Drawings and as needed to meet requirements of Contract Documents.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

1.03 DEFINITIONS

A. Influence Zone Under Foundations, Pavements, or Sidewalks: Area below foundation or pavement or sidewalk subbase bounded by 1 horizontal to 2 vertical slope extending outward from 1-foot beyond outer edge of foundation or pavement or sidewalk subbase.

B. Influence Zone Under Piping or Electrical Ducts: Area below limits bounded by line 6 inches below pipe or electrical duct and by 1 horizontal to 2 vertical slope extending outward from that line 1-foot beyond outer edge of pipe or duct.

C. Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by engineer.

1.04 SUBMITTALS

A. Test Results.

1. Compaction test results.

B. Miscellaneous Submittals.

1. Test results to verify fill materials meet Specifications.

C. Submit according to Section 01330.

1.05 QUALITY ASSURANCE

A. Testing shall be provided by contractor according to Section 01455 and this Section.

B. Sheeting, Shoring, and Bracing:

1. Sheeting, shoring, and bracing shall conform to safety requirements of federal, state, and local agencies.
2. Sheeting, shoring, and bracing shall not affect structural integrity of new construction, water tightness or waterproofing of new construction, and shall allow for sufficient clearances necessary to install associated appurtenances adjacent to new construction.
3. Sheeting, shoring, and bracing shall not penetrate walls or slabs of new construction unless approved by engineer.

1.06 PROJECT / SITE CONDITIONS

A. Notify owners of above or below ground utilities encountered during excavation operations.

B. Cap and remove or relocate services according to instructions of owners of such utilities.

C. Protect, support, and maintain conduits, wires, pipes or other utilities that are to remain according to requirements of owners of such utilities.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

A. Structural Fill:

1. Well-graded sand, well-graded sand and gravel, well-graded crushed stone or gravel, or other approved material, of 2 inch maximum size, free from organic and deleterious materials.
2. Plasticity Index: ASTM D4318, 6 or less. Plasticity Index shall be performed on fraction of material that passes the No. 40 sieve.
3. Maximum Fines: ASTM D422, 10% passing No. 200 sieve.
4. Uniformity Coefficient: 5 or greater.
5. Concrete may be used as Structural Fill when approved by engineer.

B. Flowable Fill: Lean concrete with minimum of 50 pounds of cement per cubic yard, flyash, fine and coarse aggregate, foaming agent, lightweight aggregate, and admixtures as required to achieve a flowable mix with a minimum compressive strength of 30 pounds per square inch andd a maximum unit weight of 60 pounds per cubic foot.

C. Earth Fill: Natural soils free of topsoil, wood, peat, cinders, organic and deleterious matter or other rubbish.

D. Free-Draining Fill:

1. ASTM C33, Size No. 67.
2. Washed crushed stone.
3. Maximum Fines: ASTM D422, 1% passing No. 200 sieve.

2.02 FILTER FABRIC

A. Porous non-woven fabric with multiple layers of randomly arranged fibers, min 4.0 ounce per square yard (typical).

B. Manufacturers:

1. Mirafi 140N by Mirafi, Inc.
2. Typar 340I by DuPont.
3. Supac 5P by Phillips Fibers Corp.

4. Propex 4545 by Amoco Fabrics Co.
5. Or approved equal.

2.03 SHEETING, SHORING, AND BRACING

A. Type, design, detail, and installation of sheeting, shoring, and bracing shall be determined by and sole responsibility of contractor.

2.04 SOURCE QUALITY CONTROL

A. Testing:

1. One sieve analysis, plasticity index, and uniformity coefficient for each source of structural fill.
2. One sieve analysis for each source of free-draining fill.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work, such as areas loosened by frost action or softened by flooding or weather, or existence of unsuitable material. Do not proceed until unsatisfactory conditions are corrected.

B. Proof-roll and examine surfaces to receive fill and subgrades within influence zone to determine existence of soft areas, areas loosened by frost action or softened by flooding, groundwater or weather or existence of unsuitable materials.

C. Where sensitive soils are encountered, requirement for proof rolling shall be waived, and contractor shall perform alternative field testing to determine existence of soft areas. Method of alternative testing shall be approved by engineer.

3.02 PREPARATION

A. Fill settled areas where excavations or trenches were backfilled and holes made by demolition, tree removal, and site preparation.

B. Natural soils or fill softened by frost, flooding or weather shall be removed and replaced.

C. Remove unsuitable material within influence zone under foundations, pavements, sidewalks, piping or electrical ducts.

D. Remove frozen soils within influence zone.

3.03 SHEETING, SHORING, AND BRACING

A. Whenever necessary to prevent caving during excavation and to protect adjacent piping, structures, property, workers, and the public excavations shall be sheeted, shored, and braced.

B. When sheeting, shoring, and bracing is required, install to prevent soil from entering excavation below or through sheeting.

C. Keep sheeting, shoring, and bracing in place until structure is placed, tested, and backfilled.

D. Remove sheeting, shoring, and bracing in manner not damaging to structure or permitting voids within backfill.

E. Fill settled areas after sheeting, shoring, and bracing has been removed.

3.04 DEWATERING

A. Contractor shall dewater excavation site prior to starting excavation and shall maintain groundwater minimum of 12 inches below bottom of excavation.

B. Contractor is responsible for choosing method of groundwater control.

C. If contractor chooses to use deep wells or well points, wells and well points shall be designed, installed, and operated to prevent removal of in-situ materials.

D. Keep construction site free-draining. Keep excavations free of water.

E. Remove soil disturbed by pressure or flow of groundwater.

F. Maintain dewatering system to prevent uplifting of or damage to structures.

G. Protect adjacent utilities, structures, and properties from damage resulting from dewatering operations.

H. Drill, maintain, and abandon dewatering wells according to federal, state, and local ordinances.

3.05 EXCAVATION

A. Excavate to the lines, grades, and elevations indicated and necessary to complete construction.

B. Method of excavation shall be consistent with soil types encountered and result in undisturbed subgrade. Loosened soils shall be recompacted or removed and replaced.

C. Protect excavated areas from freezing.

3.06 FILL USAGE

A. Structural: Within influence zone under footings and foundations, floor slabs, pavements, sidewalks, piping or electrical ducts. Provide a minimum 6 inch layer under floor slabs when subbase material is not granular in nature.

B. Flowable: Where noted.

C. Free-Draining: Where noted.

D. Earth: Other areas not previously specified.

3.07 PLACING FILL

A. Notify engineer before placing fill material.

B. Do not use frozen material or place fill on frozen subgrade.

C. Place filter fabric where indicated according to manufacturer's recommendations.

D. Do not backfill until concrete is properly cured and has reached 85% of design strength, coatings approved, and required tests accepted.

E. Place fill against foundation walls enclosing interior spaces after construction such as cross-walls, beams, or slabs are in-place to brace wall and such construction has reached 85% of design strength.

F. Place fill simultaneously on both sides of free standing structures.

G. Do not operate power-operated earth moving equipment closer to foundation walls or other structures than distance equal to ½ height of fill above footing.

H. Begin compaction of each layer at structure wall to minimize lateral forces against structure due to wedging action of soil.

I. Stop backfill at specified grade to allow for placing topsoil or sidewalk or pavement subbase.

J. Place and compact fill materials in lift thickness and to densities listed.

1. Degree of compaction: ASTM D1557, Modified Proctor.
2. Moisture Content: Within 3% of optimum.

Location	Maximum Lift Thickness	Modified Proctor (%)
Footing, Foundation Slab, or Floor Slab Influence Zone	8 inches	95 minimum
Sidewalk, Pavement, Piping, or Electrical Duct Influence Zone	12 inches	90 minimum
Lawn and Landscaped Areas	12 inches	80 minimum, 90 maximum

K. Free-draining fill below tanks and foundations shall be compacted in max 8-in. lifts with min 10-ton smooth vibratory roller. Make a minimum of 3 passes in each direction. In areas not accessible to roller, compact with equipment acceptable to engineer.

3.08 FIELD QUALITY CONTROL

A. Testing:

1. One field density test for each 25 cubic yards of structural fill, minimum one each lift.
2. One field density test for each 500 cubic yards of earth fill.
3. Determine in-place density of fill at maximum intervals specified according to ASTM D1556, D2167, D2922 or D2937.

3.09 ADJUSTMENT AND CLEANING

A. Owner has first right to excess material suitable for backfilling or site grading, not used in Work.

B. Place excess material not required by owner, material not suitable for backfilling or site grading, and unsuitable materials in designated spoil areas and grade to drain.

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. Provide concrete reinforcement and cast-in-place concrete where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCES

A. ACI: American Concrete Institute

B. ASTM: American Society for Testing and Materials

C. CRSI: Concrete Reinforcing Steel Institute

1.03 SUBMITTALS

A. Shop Drawings:

1. Reinforcement Shop Drawings:

Conform to ACI SP-66 showing bending diagrams, assembly diagrams, location diagrams, splicing and laps of bars, shapes, dimensions, and details for reinforcing, and stirrup spacing, accessories, and additional reinforcing at openings.

2. Verification of Mix Design:

a. Proposed mix design for each class of concrete to be used as specified using designations indicated. Provide dry weight of cement, saturated dry weight of coarse and fine aggregate, brand name and quantities of admixtures when applicable, and gallons of water required for 1 cubic yard of concrete.
b. Admixture product data.
c. Mix design shall be approved by engineer before concrete delivered to site.

B. Product Data:

1. Waterstop: Samples of material and manufacturer’s literature.
2. Curing Compound and Floor Sealer: Proposed rate of coverage and manufacturer’s literature.
3. Finishing Grout manufacturer’s literature.
4. Bonding Agent manufacturer’s literature.
5. Patching Mortar manufacturer’s literature.

C. Test Results:

1. Concrete test results.
2. Concrete delivery tickets: With each load of concrete delivered, provide duplicate tickets, one for contractor, one for engineer, with following information.

    a. Serial number of ticket.
    b. Date and truck number.
    c. Name of supplier.
    d. Class of concrete.
    e. Type of cement and cement content in bags/cu yd.
    f. Admixture brand names.
    g. Aggregate size.
    h. Time loaded.
    i. Amount of concrete in load.
    j. Gallons of water added at site and slump of concrete after addition of water.
    k. Temperature of concrete at delivery.
    l. Time unloaded.

D. Submit according to Section 01330.

1.04 QUALITY ASSURANCE

A. Do not commence placement of concrete until mix designs have been reviewed and approved by engineer.

B. Concrete Testing: Testing shall be provided by contractor according to Section 01455 and this Section.

1. Conduct tests on sample material according to methods listed below:

    a. Slump: ASTM C143.
    b. Air-Entrainment: ASTM C231.
    c. Compressive Strength: ASTM C31 and ASTM C39.

1.05 PROJECT / SITE CONDITIONS

A. Hot Weather:

1. Comply with ACI 305R.

B. Cold Weather:

1. Comply with ACI 306R.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Reinforcement:

1. Deformed Steel Bars: ASTM A615, Grade 60.

B. Cement:

1. Portland cement conforming to ASTM C150.
2. Type I or II except tricalcium aluminate (C_3A) content of Type I shall not exceed 12%.
3. Type III may be substituted for Type I when approved by engineer and additional requirements for Type I are met.

C. Aggregates:

1. ASTM C33, modified as follows:

    a. Fine aggregate: Natural sand.
    b. Coarse aggregate: Crushed gravel, crushed stone or gravel, size 67 (3/4 in. max).

D. Admixtures:

1. Air-Entraining: ASTM C260.
2. Chemical Admixtures: ASTM C494, non-corrosive and chloride free.

E. Water: Potable.

F. Premolded Joint Filler:

1. ASTM D 1751.
2. ASTM D1752, Type I, II, or III.
3. Closed cell polyethylene.

G. Waterstop:

1. Virgin polyvinyl chloride (PVC) waterstop conforming to CRD C572.
2. Dumbbell or serrated type, 6 inches wide by 3/8 inches thick, at center.
3. Splice according to manufacturer’s written instructions.

H. Floor Sealer:

1. Manufacturers:

   a. Dress and Seal 18 by L&M Construction Materials, Inc.
   b. Tuf-Seal J-35 by Dayton Superior.
   c. Or approved equal.

I. Membrane Forming Curing Compound:

   1. ASTM C309, and compatible with scheduled finishes and coatings.

J. Finishing Grout

   1. Manufacturers:

      a. Thoroseal with Acryl 60 by Thoro.
      b. Concrete Finisher with AKKRO-7T by Tamms Industries Co.
      c. SikaTop Seal 107 by Sika Corp.
      d. Or approved equal.

K. Cement Grout: Mixture of cement and fine sand in proportions used in concrete being finished.

L. Epoxy Bonding Agent:

   1. Manufacturers:

   a. Sikadur 32 Hi-Mod by Sika Corp.
   b. Epoxtite 2362 by A.C. Horn.
   c. Resi-Bond J-58 by Dayton Superior.
   d. Epobond by L&M Construction Materials, Inc.
   e. Or approved equal.

   2. Use when joining new to existing concrete.
   3. Conforming to ASTM C881.

M. Non-Epoxy Bonding Agent:

   1. Manufacturers:

      a. Weld-Crete by Larsen Products Corp.
      b. Acryl 60 by Thoro.
      c. Acrylset by Master Builders Co.
      d. Everbond by L&M Construction Materials, Inc.
      e. Or approved equal.

2. Use when joining new to existing concrete when bonding agent cannot be placed immediately prior to placement of new concrete.
3. Comforming to ASTM C1059 Type II.

N. Patching Mortar.

1. Manufacturers:

    a. Sikatop by Sika Corp.
    b. Duratop by L&M Construction Materials, Inc.
    c. Or approved equal.

2. Polymer modified cementitious fast setting mortar for repair of concrete surfaces. Consisting of liquid polymer and selected Portland cements, aggregates, accelerator, admixtures for controlling set, water reducers for workability, and corrosion inhibitor. Shall contain no chlorides, nitrates, gypsum, or lime. Shall not produce vapor barrier. Shall be thermally compatible with concrete and shall be freeze-thaw resistant.

    a. Concrete gray.
    b. 5000 psi min compressive strength.
    c. 400 pounds per square inch minimum bond strength.

2.02 CONCRETE MIX DESIGN

A. Concrete Mix: Measure and combine cement, aggregate, water, and admixtures according to ASTM C94 and ACI 211.1.

1. Air-Entrainment: Air-entrain concrete exposed to exterior or exposed to liquids.
2. Water-Cement Ratio: 0.45 maximum for Class A concrete, 0.50 max for Class B concrete.
3. Chemical Admixtures: Use is optional to aid concrete properties and allow for efficient placement. Manner of use and amount shall be according to manufacturer's written recommendations and as approved by engineer. Do not use admixtures that increase early shrinkage or negatively affect finishing.
4. Use no admixtures other than specified, unless approved by engineer.

B. Class of Concrete:

1. Furnish according to table. Cement contents listed are minimum values and shall be increased as required to attain other specified characteristics.
2. Slumps listed are maximum, except when high range water reducer is used. Maximum slump when high-range water reducer is used, 10 in.

Class	28-Day Compressive Strength (psi)	Coarse Aggregate (size no.)	Minimum Cement Content (bags/cu yd)	Air Content (%)	Slump (in.)
A	4000	67	6.0	6±1	3±1
B	3000	67	4.75	6±1	3±1
C	2000	67	2.25	---	---
psi = pounds per square inch cu yd = cubic yard in. = inches					

C. Concrete Usage:

1. Class A: All locations, except where Class B and C specified.
2. Class B: Interior equipment bases and where specifically noted.
3. Class C: Mud slabs and backfill below and around structures where noted.

2.03 FABRICATION

A. Fabricate reinforcing bars to conform to the required shapes and dimensions and according to ACI 318 and CRSI Manual.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 REINFORCEMENT Installation

A. Position, support, and secure reinforcement against displacement by formwork, construction, and concrete placing operations. Unless otherwise noted, provide clear cover as follows:

Cast against earth:	3 inches
#5 Bars and smaller:	1 1/2 inches
#6 through #11 bars:	2 inches

B. Correct displacement of reinforcement prior to and during concrete placement. Maintain clear cover as noted on Drawings. Tolerances shall be according to ACI 117 and ACI 318, unless noted otherwise.

C. Support reinforcing steel according to CRSI “Placing Reinforcing Bars” with max spacing of 4 feet.

D. Tie reinforcing steel at intersections according to CRSI “Placing Reinforcing Bars”.

1. Spacing for Footings, Walls, and Columns: Every third intersection, 3 feet maximum.
2. Spacing for Slabs and Other Work: Every fourth intersection, 3 feet maximum.
3. Tie each dowel in-place.

E. Lap reinforcing at splices. Tie securely to prevent displacement of splices during placement of concrete.

3.03 FORMS

A. Formwork design, detailing, and installation shall be Contactor’s responsibility and shall conform to ACI 347R.

B. Conform to tolerances as specified in ACI 117.

3.04 SUBGRADE PREPARATION

A. Subgrade and bedding shall be compacted and free of frost. If placement occurs at temperatures below freezing, provide temporary heat and protection to remove frost. Do not place concrete on frozen material.

3.05 PLACING CONCRETE

A. Notify engineer 24 hours in advance of placing operations.

B. Place concrete, except as modified herein, according to ACI 304R.

C. Place in lifts not exceeding 24 inches and compact with internal mechanical vibrator equipment.

D. Provide bonding agent between new and hardened or existing concrete where shown. Existing concrete shall be sandblast cleaned to remove all foreign materials, to expose the coarse aggregate, and result in a roughened surface with minimum amplitude of 1/8 inch.

3.06 JOINTS

A. Unless otherwise noted, construction joints shown are optional. Joints not shown on Drawings shall be approved by engineer. Locate to miss splices in reinforcement.

B. Limit size of concrete pours. Max length of wall and slab pours shall not exceed 60 feet.

C. Construction joints shall have keys or roughened surfaces. Where roughened surface used, surface shall have amplitude of 1/4 inch minimum.

3.07 WATERSTOP

A. Provide waterstop in construction joints in locations shown on the Drawings.

B. Secure in place. Install according to manufacturer's recommendations.

3.08 EMBEDDED ITEMS

A. Cast pipe and other embedded items into concrete as placement progresses. Do not provide blockouts.

B. Do not place ducts, conduit, and pipes in slabs on grade. Place minimum 4 inches below slab.

C. Place items constructed of dissimilar metals to avoid physical contact with reinforcing. Secure item and reinforcing to ensure they will not shift and come into contact during concrete placement. Contact between reinforcing steel and other metal, other than bare, coated, or plated carbon steel not permitted.

3.09 REPAIR OF SURFACE DEFECTS

A. Tie Holes: Fill tie holes with Patching Mortar.

B. Defective Areas:

1. Remove honeycombing, stone pockets, spalls, and other defective concrete down to sound concrete. If chipping required, make edges perpendicular to surface. Do not feather edges.
2. Fill defective area with Patching Mortar.

3.10 FINISHING SLABS AND FLATWORK

A. Slab Finishes:

Description	Concrete Finish
Surfaces to Receive Grout or Topping	Float
Submerged and Buried Slabs	Float
Slabs with Floor Coverings	1 Troweling
Sealer Applied Floors and Slabs	3 Trowelings
Exterior Exposed Slabs	Float and Broom Finish
Exterior Stairs and Walks	Float and Broom Finish
Interior Stairs	I Troweling and Broom Finish

B. Floor Sealer: Apply according to manufacturer's written instructions.

C. For special coatings or finishes, see room finish schedule.

D. Tolerances:

1. Concrete slabs shall be within 3/16 inches of 10 feet straightedge in all directions except where slabs are dished for drains. Deviations from elevation indicated shall not exceed 3/4 inches.
2. Pitch floor to floor drains min 1/8 inch per foot or as shown.

3.11 FINISHING FORMED CONCRETE

A. As-Formed Finish: Finish resulting directly from formwork for surfaces which will be hidden from view by earth or subsequent construction.

1. Repair surface defects as specified herein.

B. Smooth Finish: Interior concrete surfaces permanently exposed to view and concrete surfaces scheduled to be painted.

1. Repair surface defects as specified herein.
2. Grind joint marks and fins smooth with adjacent surface. Remove stains and rinse.
3. Dampen concrete and paint entire surface with Cement Grout. Work grout into surface with suitable float. When grout has set to where it will not be pulled out of holes or depressions, brush off surface with burlap or carpet.
4. Prepare surface to be painted according to Section 09960 and paint manufacturer's recommendations.

C. Rubbed Finish: Exterior concrete surfaces permanently exposed to view extending to 6 inches below finished grade.

1. Repair surface defects as specified herein.
2. Grind joint marks and fins smooth with adjacent surface. Remove stains and rinse.
3. Apply heavy coat of Finishing Grout. After first coat has set, apply second coat. When second coat has set, float to uniform texture.
4. Follow manufacturer's written recommendations.
5. Finish color shall be gray.

3.12 PROTECTION AND CURING

A. Protect concrete from frost and keep moist for min curing period of 7 days after placement according to ACI 308.

B. Cure using curing compound or wet cure. Do not use curing compound where mortar, grout, concrete, or other coatings or adhesives will be applied.

C. Do not load self-supporting structures to overstress concrete.

3.13 FIELD QUALITY CONTROL

A. Obtain samples of concrete according to ASTM C172

B. Make slump tests daily and when requested by engineer, according to ASTM C143.

C. Make air content tests daily and when requested by engineer, according to ASTM C231.

D. Make strength tests daily for each class of concrete according to ASTM C39.

E. Strength of concrete considered satisfactory if following requirements met.

1. Average of all sets of 3 consecutive strength tests equal or exceed specified 28-day compressive strength.
2. No individual strength test falls below specified 28-day compressive strength by more than 500 pounds per square inch.

SECTION 03400 – PRECAST CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. Provide precast prestressed concrete roof members where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCES

A. ACI: American Concrete Institute

B. PCI: Precast Concrete Institute

C. ASCE: American Society of Civil Engineers

1.03 SYSTEM DESCRIPTION

A. Precast manufacturer shall be responsible for structural design of individual precast prestressed components and connections between components.

B. Design, reinforce, and prestress units as required by ACI 318, PCI Design Handbook, local building code, and as specified herein.

C. Design and provide members capable of supporting superimposed loads shown on Drawings including following:

1. Roof Live Load:

    a. 21 pounds per square foot snow.
    b. 10 pounds per square foot mechanical.

2. Roofing Superimposed Dead Load: 25 pounds per square foot.
3. Wind Load: per ASCE 7
4. Increased snow loads (drift) according to ASCE 7.
5. Seismic Load: 0.01*W.

D. Provide 1-1/2 hour UL fire resistance rated units unless otherwise noted.

E. Roof plank shall be hollow core Machine Cast (Dry Cast) units.

F. Conform to the shapes indicated.

1.04 SUBMITTALS

A. Shop Drawings:

1. Content:

    a. Dimensions.
    b. Design loads.
    c. Design camber.
    d. Fabrication details.
    e. Details of inserts, anchors, connections, accessories, joints, and openings.
    f. Chamfer and radius of corners.
    g. Reinforcement and tendons.
    h. Welds.
    i. Finishes.
    j. Lifting positions and devices.

2. Erection drawings including piece numbers and table referencing piece numbers to standard unit designations.
3. Shop Drawings shall bear seal of professional engineer registered in State of Wisconsin.

B. Product Data:

1. Catalog or table information for standard precast units.

C. Miscellaneous Submittals:

1. Evidence of certification or experience qualifications, when requested by engineer.

2. Wisconsin Department of Commerce Submittal: Submit after approval by engineer.

a. Four sets of sealed shop drawings.
b. One set of sealed design calculations.
c. One copy of partially completed Plans Approval Application form.

D. Submit according to Section 01330.

1.05 QUALITY ASSURANCE

A. Conduct testing according to PCI MNL-116.

B. Shop Inspection:

1. Shop inspection may be required by owner at owner's expense. Contractor shall give min 7 days' notice to engineer prior to starting fabrication and shipment of completed components so inspection may be provided.
2. Shop inspection intended as means of facilitating work and avoiding errors, but will in no way relieve contractor from responsibility for furnishing proper materials and workmanship required by these specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Follow manufacturer's written instructions for handling and storage.

B. Store units at the job site in a manner to prevent cracking, distortion, warping, staining, and other physical damage, and in a manner to keep markings visible.

C. Lift and support the units only at designated lifting points or supporting points as shown on the approved shop drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Spancrete.

B. County Materials.

C. Firms specializing in providing precast prestressed concrete products and services normally associated with industry for at least 3 years.

D. Manufacturers meeting requirements of PCI MNL-116.

E. Manufacturers may be required to submit written evidence showing experience, qualifications, and adequacy of plant, facilities, and ability to perform Work.

2.02 MATERIALS

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

B. Admixtures:

1. Chemical: ASTM C494, non-corrosive and chloride free.

C. Aggregates:

1. ASTM C33.
2. Natural materials.
3. Maximum 3/4 inch.

D. Water: Potable.

E. Reinforcing Steel:

1. Deformed Steel Bars: ASTM A615, Grade 60.
2. Welded Wire Fabric: ASTM A185.
3. Fabricated Steel Bar Mats: ASTM A184.

F. Fiber Reinforcement:

1. Manufacturers:

a. W.R. Grace & Co.
b. Fibermesh Co.
c. Euclid Chemical Co.
d. Or approved equal.

2. 1/2 inch to 3/4 inch collated fibrillated virgin polypropylene fibers.
3. ASTM C1116 Type III.

G. Tendons: Uncoated, stress-relieved strand, ASTM A416, Grade 250K or 270K. Low relaxation strand conforming to Supplement 1 may be used.

H. Anchors and Inserts:

1. ASTM A36 or ASTM A307. Hot dip galvanized.
2. 304 stainless steel bolts.
3. Types as indicated on the drawings or as approved by engineer.

I. Cement Grout: One part Portland cement and 3 parts sand.

J. Bearing Pads:

1. Hollow Core Plank: 1/8 inch thick tempered hardboard or high-density plastic.

K. Joint Sealants and Accessories: Conform to requirements of Section 07920.

2.03 MIX DESIGN

A. Mix design shall be according to manufacturer's recommendations.

B. Concrete Properties:

1. 28-Day Compressive Strength:

a. Minimum 4000 pounds per square inch for hollow core plank.

2.04 FABRICATION

A. Formwork:

1. Construct forms to maintain units within specified tolerances with radius or chamfer corners.
2. Locate lifting devices to not harm appearance of unit in finished position.
3. Form treatments or curing compounds shall not contain ingredients which might stain concrete or reduce bond with subsequent coatings, finishes, etc.

B. Reinforcement:

1. Pretension tendons according to PCI MNL-116.
2. Provide reinforcement necessary to resist applied loads, handling and erection.

C. Locate lifting devices to not harm appearance of unit in finished position.

D. Accurately and rigidly position embedded items during concrete placement. Avoid contact of dissimilar metals.

E. Batch, mix, and handle concrete according to ACI and PCI recommendations.

F. Cure units according to PCI MNL-116.

G. Detensioning:

1. Detension units after concrete has reached release strength according to design.
2. If heat cured, perform detensioning while unit is still warm.
3. Detension tendons in gradual sequence to prevent shock and unbalanced loads.

H. Finishes:

1. Unexposed Areas: As cast.
2. Interior Exposed Faces of Roof Plank:

    a. Cast against concrete or steel casting beds maintained according to industry practice.
    b. Surface holes, chips, and spalls shall not exceed 1/4 inch.
    c. Casting bed offsets and finish shall not exceed 1/8 inch.

3. Permanently exposed surfaces shall be consistent in appearance over entire area. Spotty coloring not accepted.

I. Fabrication tolerances shall conform to requirements of PCI MNL-116.

1. Edges of units shall be true and parallel and not vary from a straight line more than 1/8 inch at any point.
2. Edges shall be parallel within maximum variation of 1/8 inch at any point.
3. Faces shall not vary from flat plane more than 1/8 inch at any point.
4. Maximum warpage prior to installation shall not exceed that which can be corrected during installation.

2.05 ANCHORS, HOLES, AND FRAMING

A. Provide pipes, sleeves, inserts, weld plates, anchor plates, anchor bolts, bolts, concrete anchors, and other embedded items shown and as required. Place dissimilar metals to avoid physical contact between them.

B. Furnish inserts, plates, fastening devices, and anchors to be set in supporting structure.

C. Provide anchor straps, plates, angles, bolts, and other items as required to connect individual members to each other and supporting structure.

D. Holes shall be formed during manufacture of units, or field cut or cored. Location shall be coordinated with manufacturer. Do not cut tendons without manufacturer’s consent. Over cutting will not be allowed. Edges of holes shall be neat and square, spalled edges will not be allowed.

E. Large Openings:

1. Design and provide steel headers.
2. Reinforce units adjacent to units with large openings to support additional dead and live load caused by opening.

F. At holes and along cut edges of hollow core units, exposed cores shall be grouted solid within 6 inches of hole or cut edge.

2.06 SOURCE QUALITY CONTROL

A. Comply with applicable requirements of PCI MNL-116.

1. Make one compression test for each day's production of each type of member.
2. Test cylinders shall be cast from the same materials and by the same methods as the precast units, and shall be cured in the same manner as the precast units.
3. Compression test shall conform to ASTM C39.

B. Failure of any member to come within tolerances specified herein shall be cause for rejection.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Erect units according to manufacturer's written instructions.

B. Do not bear units on cast-in-place concrete or masonry construction until support has reached 80% of design strength.

C. Provide bearing pads set on level and uniform bearing surfaces.

D. Do not place warped, cracked, or broken units.

E. Ends of units may be saw cut if required for proper clearance. Do not break units with hammer to produce proper clearance.

F. Set units straight, level, plumb, and square.

G. Provide temporary supports and bracing as required to maintain position, stability, and alignment until units are permanently connected.

H. Perform welding according to AWS D1.1 and AWS D1.4.

I. Remove lifting devices and grout flush with adjacent surface.

J. Repair damaged surfaces to match adjacent surfaces.

K. Anchor hollow core units to supporting members as shown. When approved by engineer, anchors may be drilled and grouted into supporting structure.

L. Erection Tolerances:

1. Roof Plank:

a. Alignment between units and along other structural elements: Maximum 1/8 inch per 10 feet, vertical and horizontal.
b. Elevation between adjacent roof or floor members: Maximum difference 3/4 inch at any point.
c. Gaps between adjacent roof or floor units: Maximum 1/4 inch.

3.03 GROUTING, POINTING, AND CAULKING

A. Roof Units: Grout joints between hollow core roof units from top of unit, and finish on underside before hardening as follows:

1. Where units to be exposed: Rake joints 1/2 inch deep and fill with sealant, finish smooth.
2. Unexposed areas and areas with suspended ceilings: Rough formed or rough broomed.
3. Trowel top of grout joints on roofs smooth to prevent unevenness interfering with placing of, or causing damage to, insulation or roofing. Slope due to differential elevations shall not exceed 1:12.

3.04 CLEANING

A. Clean exposed surfaces with water, rinse thoroughly.

SECTION 03610 – NON SHRINK GROUT

PART 1 – GENERAL

1.01 SUMMARY

A. Cement based grout for setting equipment and column base plates.

1.02 RFERENCES

A. ASTM: American Society for Testing and Materials

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer’s literature.

B. Submit according to Section 01330.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers:

1. Five Star NBEC by Five Star Products, Inc.
2. SET Grout by BASF.
3. Duragrout by L&M Construction Chemicals, Inc.
4. SikaGrout 212 by Sika Corp.
5. Or approved equal.

B. Grout:

1. Preblended, cement based, nonmetallic, nongas forming, nonshrink and shall not bleed.
2. Comply with ASTM C1107 and CRD C621, Grade B.
3. Moderate fluidity.
4. 5000 pounds per square inch minimum compressive strength.

C. Water: Potable.

PART 3 – EXECUTION

3.01 PREPARATION

A. Clean grout contact surfaces of oil, grease, scale, and other foreign matter.

B. Chip away unsound concrete leaving surface rough but level.

C. Clean base plates, rails, anchors, bolts, etc. in contact with grout of oil, grease, dirt, and coatings.

3.02 MIXING AND PLACING

A. Mix and place according to manufacturer’s written instructions.

B. Provide forming materials where necessary to retain grout until hardened.

C. Work grout from one side. Avoid trapping air under base plate.

D. Do not load grout until it has reached a minimum of 3000 pounds per square inch compressive strength.

3.03 CURING

A. Cure as recommended by grout manufacturer.

SECTION 04210 – BRICK MASONRY

PART 1 – GENERAL

1.01 SUMMARY

A. Provide clay brick masonry where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. ACI: American Concrete Institute

1.03 SUBMITTALS

A. Shop Drawings:

1. Source, material certificates, and proportions by weight of cement, fine aggregate, and admixtures for mortar.

B. Product Data:

1. Brick cleaner manufacturer's literature.
2. Flashing manufacturer's literature.
3. Weep hole manufacturer's literature.

C. Samples:

1. Brick.
2. Flashing.

D. Miscellaneous Submittals:

1. Material certification for brick units. Test data shall not be more than 5 years old.

E. Submit according to Section 01330.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units above ground on level platforms which allow air circulation under the stacked units.

B. Cover and protect against wetting prior to use.

1.05 PROJECT / SITE CONDITIONS

A. Cold Weather Protection:

1. Temperature of masonry units shall not be less than 32°F when laid.
2. When air temperature falls below 40°F or when temperature of masonry units is below 40°F:

    a. Remove visible ice on masonry units before unit is laid.
    b. Heat mortar sand or mixing water to produce mortar temperature between 40°F and 120°F.
    c. When air temperature is between 25°F and 40°F, completely cover masonry by covering with weather resistant membrane for 24 hours after construction.
    d. When air temperature is between 20°F and 25°F, use heat sources, install wind breaks when wind velocity exceeds 15 miles per hour, and completely cover masonry with insulating blankets for 24 hours after construction.
    e. When air temperature is below 20°F, provide enclosure and use heat source to maintain temperature within enclosure above 32°F for 24 hours after construction.

B. Hot Weather Protection:

1. When air temperature exceeds 100°F, or 90°F with wind velocity greater than 8 miles per hour:

    a. Do not spread mortar more than 4 feet ahead of masonry.
    b. Set units within 1 minute of spreading mortar.

PART 2 – PRODUCTS

2.01 MORTAR AND GROUT

A. Materials:

1. Portland Cement: ASTM C150, Type I.
2. Masonry Cement: ASTM C91, Type S.
3. Lime: Hydrated lime, ASTM C207, Type S.
4. Sand: ASTM C144, acceptable in color, 10% passing No. 100 sieve.
5. Water: Potable.
6. Coloring Pigments: Commercial iron oxide, manganese dioxide, or chromium oxide of color selected by engineer.
7. Do not use antifreeze compounds.
8. Do not use water repellant admixture.

B. Proportions: ASTM C270, property specification Type S (1800 pounds per square inch).

2.02 BRICK MASONRY UNITS

A. Face Brick:

1. Standard size units conforming to ASTM C216, Grade SW, Type FBX.
2. Provide specials shapes where indicated on Drawings, and as required for complete and proper installation.

2.03 REINFORCEMENT AND ANCHORS

A. Dovetail Anchor Slots and Anchors:

1. 20 gauge galvanized dovetail foam filled anchor slots compatible with anchors.
2. 16 gauge by 1 inch galvanized corrugated, dovetailed metal anchor straps.
3. Zinc coated according to ASTM A153, Class B2.

2.04 WEEPHOLE MATERIAL

A. 1/4 inch diameter plastic or rubber tube.

B. Cotton sash cord.

2.05 FLASHING

A. Rubberized asphalt sheet flashing with metal drip edge.

B. Sheet Flashing:

1. Perm-A-Barrier as manufactured by W. R. Grace & Co.
2. Dur-O-Barrier as manufactured by Dur-O-wall.
3. A self-sealing, self-healing, fully adhered composite flexible, self-adhesive, cold applied sheet consisting of a minimum of 32 mils of rubberized asphalt bonded to an 8 mil high density cross laminated polyethylene film.

C. Metal drip edge shall be 24 gauge, G-90 galvanized commercial quality prefinished steel sheet, coated with a high performance fluoropolymer coating (Kynar 500). Color as selected by engineer. Drip edge shall be minimum 2 ½ inches wide with 5/8 inch 135 degree drip and minimum 1/4 inch hem along outside edge.

D. Accessories: Primer, conditioner, adhesive, and mastic compatible with the sheet flashing as recommended by the sheet flashing manufacturer.

2.06 Brick Cleaner

A. Manufacturers:

1. Sure Klean
2. Envirosafe Manufacturing
3. Or approved equal.

B. As recommended by brick manufacturer.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 BRICK MASONRY UNITS

A. General:

1. Use only brick that are clean and free of dust and other foreign matter.
2. Use masonry saws to cut and fit masonry units.
3. Set units plumb, true to line, with level courses accurately spaced, and with square angles and corners.
4. Clean the top surface of foundation free from dirt and debris prior to start of installing first course.
5. Where brick are moved or shifted, remove and lay again on fresh mortar.

B. Wetting:

1. Brick which have an initial rate of absorption (suction) greater than 30 grams per 30 square inch per minute, as measured according to ASTM C67, shall be wetted prior to laying except when air temperature falls below 40°F or when temperature of units is below 40°F.
2. Use wetting method which will assure each unit is nearly saturated but surface dry when laid.

C. Unless otherwise shown on the Drawings, provide running bond with vertical joints located at center of masonry units in the alternate course below.

D. Do not use chipped or broken units. If such units are discovered in the finished wall, engineer may require their removal and replacement with new units at no additional cost to the owner.

E. Laying up:

1. Place units in mortar with full bed and head joints.
2. Where brick laid against cast-in-place or precast concrete, provide vertical dovetail anchor slots at 2 feet on center, with dovetail anchors at 16 inches on center.
3. Where brick laid against concrete masonry units, provide horizontal joint reinforcement according to Section 04220.

F. Tooling:

1. Tool joints to a dense, smooth surface.
2. Unless otherwise shown on the Drawings, provide joints of "concave" pattern throughout.
3. Brush with soft brush to remove projecting mortar.

G. Provide control joints where shown. Conform to details shown.

H. Flashing:

1. Clean surface of masonry smooth and free from projections which might puncture or otherwise damage flashing.
2. Install according to manufacturer’s recommendations to provide continuous flashing system.
3. Provide end dam at each end of flashing to funnel flow out of wall.
4. Turn up sheet flashing a minimum of 8 inches and fully adhere to substrate.
5. Fully adhere sheet flashing to top of metal drip edge and cut off sheet flashing ½ inch back from exterior face.
6. In cold or wet weather when flashing will not fully adhere to substrate, provide termination bar mechanically anchored to substrate at top of flashing to secure flashing in place.

I. Provide weepholes by omission of 1 inch of mortar head joints or provide tubes or sash cord at base of flashings. Space not over 32 inches on center with a minimum of 1 weephole between openings. Keep weepholes and area above flashings free of mortar.

J. Build into masonry rough frames, metal frames, lintels, anchors, anchor bolts, inserts, sleeves, brackets, etc.

K. Install insulation into cavities of exterior walls. Conform to requirements of Section 07210.

L. Tolerances: Conform to requirements of ACI 530.1.

3.03 Protection

A. Protect masonry from damage.

B. Cover freshly laid masonry and walls not being worked on to prevent rapid drying and to exclude rain and snow.

3.04 CLEANING

A. Clean as units are set and daily.

B. Remove surplus mortar and leave surface clean and finished.

C. Upon completion, visually inspect Work and point, or cut out and repoint all holes and defective joints.

D. Thoroughly clean all brick surfaces to be left exposed in finished work. Use brick cleaner according to manufacturer's recommendations. Acid shall not be used.

SECTION 04220 – CONCRETE UNIT MASONRY

PART 1 – GENERAL

1.01 SUMMARY

A. Provide concrete unit masonry where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. ACI: American Concrete Institute

1.03 SUBMITTALS

A. Shop Drawings:

1. Source, material certificates, and proportions by weight of cement, fine and coarse aggregates, and admixtures for mortar and masonry grout.
2. Bar reinforcement shop drawings.

B. Product Data:

1. Wall reinforcing and anchors manufacturers literature.

C. Miscellaneous Submittals:

1. Material certification for masonry units. Test data shall not be more than 1 year old.

D. Submit according to Section 01330.

1.04DELIVERY, STORAGE, AND HANDLING

A. Store masonry units above ground on level platforms which allow air circulation under the stacked units.

B. Cover and protect against wetting prior to use.

1.05 PROJECT / SITE CONDITIONS

A. Cold Weather Protection:

1. Temperature of masonry units shall not be less than 32°F when laid.
2. When air temperature falls below 40°F or when temperature of masonry units is below 40°F:

a. Remove visible ice on masonry units before unit is laid.
b. Heat mortar sand or mixing water to produce mortar temperature between 40°F and 120°F.
c. When air temperature is between 25°F and 40°F, completely cover masonry by covering with weather resistant membrane for 24 hours after construction.
d. When air temperature is between 20°F and 25°F, use heat sources, install wind breaks when wind velocity exceeds 15 miles per hour, and completely cover masonry with insulating blankets for 24 hours after construction.
e. When air temperature is below 20°F, provide enclosure and use heat source to maintain temperature within enclosure above 32°F for 24 hours after construction.

B. Hot Weather Protection:

1. When air temperature exceeds 100°F, or 90°F with wind velocity greater than 8 miles per hour:

    a. Do not spread mortar more than 4 feet ahead of masonry.
    b. Set units within 1 minute of spreading mortar.

PART 2 – PRODUCTS

2.01 MORTAR AND GROUT

A. Materials:

1. Portland Cement: ASTM C150, Type I.
2. Masonry Cement: ASTM C91, Type S.
3. Lime: Hydrated lime, ASTM C207, Type S.
4. Aggregates:

    a. Mortar: ASTM C144, acceptable in color, 10% passing No. 100 sieve.
    b. Masonry Grout: ASTM C404.
5. Water: Potable.
6. Do not use antifreeze compounds.

B. Proportions:

1. Mortar: ASTM C270, property specification Type S (1800 pounds per square inch).
2. Masonry Grout: ASTM C476 (2500 pounds per square inch minimum).

2.02 CONCRETE MASONRY UNITS

A. Hollow Normal Weight Concrete Block: ASTM C90.

B. Provide special block for corners, control joints, jambs, sills, lintels, bond beams, etc. Joints at outside corners are not acceptable.

C. Provide bull nose edges where shown and at all interior exposed vertical corners, including door openings.

2.03 REINFORCEMENT AND ANCHORS

A. Horizontal Joint Reinforcement:

1. Truss, Ladur, Ladur Tri-Rod, CRT, Dur-o-Tab, adjustable CRT, adjustable Dur-o-Tab by Dur-O-Wall, Inc.
2. 2 or 3 longitudinal 9 gauge galvanized rods welded to 9 gauge cross rods at 16 inches on center, conforming to ASTM A82.
3. Provide special manufactured corner and wall intersection pieces.
4. Zinc coated.
   a. Exterior walls: ASTM A153, Class B2.

B. Reinforcing Bars: Conform to requirements of Section 03300.

C. Dovetail Anchor Slots and Anchors:

1. 20 gauge galvanized dovetail foam filled anchor slots compatible with anchors.
2. 16 gauge by 1 inch galvanized corrugated, dovetailed metal anchor straps. Where heavy duty anchors are called for, provide 3/16 inch thick anchor straps.
3. Zinc coated according to ASTM A153, Class B2.

2.04 WEEPHOLE MATERIAL

A. 1/4 inch diameter plastic or rubber tube.

B. Cotton sash cord.

2.05 FLASHING

A. Conform to the requirements of Section 04210.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 CONCRETE MASONRY UNITS

A. General:

1. Use normal weight block for backing for exterior walls.
2. Lay only dry masonry units.
3. Use masonry saws to cut and fit masonry units.

4. Set units plumb, true to line, and with level courses accurately spaced.
5. Clean the top surface of foundation free from dirt and debris prior to start of installing first course.
6. Accurately fit the units to plumbing, ducts, openings, and other interfaces, neatly patching all holes.
7. Keep the walls continually clean, preventing grout and mortar stains. If grout does run over, clean immediately.

B. Unless otherwise shown on the drawings, provide running bond with vertical joints located at center of masonry units in the alternate course below.

C. Do not use chipped or broken units. If such units are discovered in the finished wall, engineer may require their removal and replacement with new units at no additional cost to the owner.

D. Laying up:

1. Place units in mortar with full bed and head joints where cells are to be filled with mortar or masonry grout. Other masonry shall have face-shell bedding.
2. Align vertical cells of hollow units to maintain a clear and unobstructed system of flues.
3. Reinforce walls with continuous horizontal joint reinforcement spaced at 16 inches on center. Reinforce parapets with continuous horizontal joint reinforcement spaced at 8 inches on center. Lap reinforcement minimum of 8 inches, and stagger laps minimum of 32 inches.
4. Bond intersections of walls with horizontal joint reinforcement, conform to details shown.
5. Tie / reinforce cavity walls with horizontal joint reinforcement.
6. Where block laid against cast-in-place or precast concrete, provide vertical dovetail anchor slots at 2 feet on center with dovetail anchors at 16 inches on center.

E. Bar Reinforcement:

1. Provide reinforcement as shown on the drawings.
2. Provide required metal accessories to ensure adequate alignment of steel during grout filling operations.
3. Unless otherwise shown, provide continuous bond beam around top of buildings at roof bearing elevation. Reinforce with 2 No. 5 bars.

F. Tooling:

1. Tool joints to a dense, smooth surface.
2. Unless otherwise shown on the drawings, provide joints of "concave" pattern throughout.
3. Brush with soft brush to remove projecting mortar.
4. Cut mortar flush with surface on concealed surfaces.

G. Provide control joints where shown. Conform to details shown.

H. Provide reinforced masonry lintels over openings where noted and where steel lintels not provided. Form lintels by using bond beam units to match wall texture. Lintels shall bear on masonry minimum 8 inches beyond each side of opening. Openings 4 feet and less in width, that do not have a lintel scheduled, shall have 8 inch high reinforced masonry lintels reinforced with 2 No. 5 bars or double steel angle lintels. Steel lintels shall conform to requirements of Section 05500.

I. Flashing:

1. Conform to the requirements of Section 04210.

J. Provide weephole tubes or sash cord at base of flashings. Space not over 32 inches on center with a minimum of 1 weephole between openings. Keep weepholes and area above flashings free of mortar.

K. Build into masonry rough frames, metal frames, lintels, anchors, anchor bolts, inserts, sleeves, brackets, bearing plates, etc.

L. Install insulation into cavities of exterior walls. Conform to requirements of Section 07210.

M. Tolerances: Conform to requirements of ACI 530.1.

3.03 GROUTING

A. Perform grouting in strict accordance with the provisions of ACI 530.1.

1. Spaces to be grouted shall be free of mortar droppings, debris, and loose aggregate.
2. Provide cleanouts at the bottom of each cell containing vertical reinforcement when pour height exceeds 4 feet.
3. Solidly fill vertical cells containing reinforcement with masonry grout.
4. Fill cores under lintels with masonry grout.
5. Consolidate grout at time of pour by puddling with a mechanical vibrator, filling all cells of the masonry, and then reconsolidating later by puddling before the plasticity is lost.

3.04 PROTECTION

A. Protect masonry from damage.

B. Cover freshly laid masonry and walls not being worked on to prevent rapid drying and to exclude rain and snow.

C. Brace walls until roof or floor system in-place.

D. Do not apply superimposed loads until completed masonry reaches design strength.

3.05 CLEANING

A. Clean as units are set, daily, and upon completion. Acid shall not be used.

B. Remove surplus mortar and leave surface clean and finished.

SECTION 05500 – METAL FABRICATIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide miscellaneous metal work shown on the drawings, as specified herein, and as needed for a complete and proper installation.

B. Section Includes:

1. Concrete anchors.
2. Lintels.
3. Metal frames.
4. Miscellaneous items.

1.02 REFERENCES

A. AISC: American Institute of Steel Construction

B. AA: Aluminum Association

C. AWS: American Welding Society

D. ASTM: American Society for Testing and Materials

E. AISI: American Iron and Steel Institute

F. OSHA: Occupational Safety and Health Administration

1.03 SUBMITTALS

A. Shop Drawings:

1. Indicate materials, sizes, connections, anchors, and finishes.

B. Product Data:

1. Manufacturer’s catalog sheets on premanufactured items.

C. Submit according to Section 01330.

1.04 QUALITY ASSURANCE

A. Perform shop and/or field welding required in connection with the work of this section in strict accordance with pertinent recommendations of AWS.

B. Conform to AISC and AA standards.

PART 2 – PRODUCTS

2.01 MATERIALS

A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, and roughness.

B. Comply with following standards, as pertinent.

1. Steel plates and shapes: ASTM A992 (WF and WT Sections) or A36 (All Other).
2. Square or rectangular tubing: ASTM A500, Grade B.
3. Round tubing or pipe: ASTM A53, Type E or S, Grade B.
4. Stainless Steel:

    a. Interior uses: AISI, Type 304 or Type 316.

5. Aluminum shapes and plates: Alloy 6061-T6 or 6063-T6.
6. Connection Bolts:

    a. For steel members: ASTM A325.
    b. For wood memebers: ASTM A307 galvanized.
    c. For aluminum and galvanized steel members: Stainless steel.

7. Cast-in-place Anchor Bolts:

    a. 1/2 inch minimum diameter.
    b. Stainless steel.

8. Malleable Iron: ASTM A47.
9. Cast Iron: ASTM A48, Class 35B.
10. Ductile Iron: ASTM A536, Grade 65-45-12.
11. Cast Aluminum: ASTM B26.

2.02 CONCRETE ANCHORS

A. Wedge Anchors:

1. Manufacturers:

a. Power-Stud+ SD1 or SD2 by Powers Fasteners.
b. Kwik Bolt 3 or Kwik Bolt TZ by Hilti Corp.
c. Ankr-Tite CCAT Wedge Anchor by Wej-it Fastening Systems.
d. Strong-Bolt or Strong-Bolt 2 by Simpson Strong-Tie Co., Inc.
e. Red Head Trubolt + or Trubolt Wedge Anchor by ITW Commercial Construction
f. Or approved equal.

2. Usage: In concrete.

a. 316 stainless steel.
b. Do not use when subjected to dynamic loads.

B. Expansion Anchors:

1. Manufacturers:

a. Power-Bolt+ by Powers Fasteners.
b. HSL-3 by Hilti Corp.
c. Or approved equal.

2. Usage: In concrete.

a. 316 stainless steel.
b. Do not use in overhead applications or subjected to dynamic loads.

C. Sleeve Anchors:

1. Manufacturers:

a. Lok-Bolt AS by Powers Fasteners.
b. HLC by Hilti Corp.
c. Sleeve Anchors by Wej-it Fastening Systems.
d. Sleeve-All by Simpson Strong-Tie Co., Inc.
e. Red Head Dynabolt Sleeve Anchor by ITW Commercial Construction
f. Or approved equal.

2. Usage: In masonry.

    a. 316 stainless steel.

D. Undercut Anchors:

1. Manufacturers:

    a. Maxi-Bolt by Drillco Devices Ltd.
    b. HDA Undercut Anchor by Hilti Corp.
    c. Torq-Cut by Simpson Strong-Tie Co., Inc.
    d. Or approved equal.

2. Usage: In concrete, overhead applications, and for dynamic loads.

    a. 316 stainless steel.
    b. Do not use when submerged.

E. Adhesive Anchors:

1. Manufacturers:

    a. HIT RE 500-SD or HY 150 MAX (MAX-SD) Epoxy Adhesive Anchor by Hilti Corp.
    b. AC100+ Gold or PE 1000+ by Powers Fasteners.
    c. AT or SET-XP Epoxy Adhesive System by Simpson Strong-Tie Co., Inc.
    d. Red Head Epcon S7, A7, G5 or C6 Adhesives by ITW Commercial Construction
    e. Or approved equal.

2. Epoxy adhesive with 316 stainless steel stud assembly.
3. Usage:

    a. In concrete.
    b. In masonry, provide tube screen inserts.
    c. Do not use in overhead applications.

F. Adjustable Anchors:

1. Manufacturers:

    a. Deco.
    b. Unisorb.

2. Usage: In concrete, for hanging supports from concrete ceilings.

G. Wedge Inserts:

1. Manufacturers:

    a. Peerless ¾ L by Richmond Screw Anchor Co.
    b. F-7-L by Dayton Superior Corp.
    c. Or approved equal.

2. Cast iron housing with wedge-bearing surface and special askew head bolt.
3. Minimum allowable working load capacity: 3000 pounds.
4. Usage: In concrete for anchoring shelf angles.

H. Screw Anchors:

1. Manufacturers:

    a. Kwik-Con II or Kwik HUS / HUS-EZ by Hilti Corp.
    b. Wedge-Bolt+ or Tapper+ by Powers Fasteners.
    c. Titen or Titen HD by Simpson Strong-Tie Co., Inc.
    d. Red Head Tapcon or Large Diameter Tapcon (LDT) Anchors by ITW Commercial Construction
    e. Or approved equal.

2. ¼ inch diameter stainless steel concrete/masonry screw with hex head.
3. Usage:

    a. In concrete, only where noted
    b. In masonry, only where noted.

I. Hollow Core Plank Anchors:

1. Manufacturers:

    a. Hollow-Set Dropin Anchor or Mini Dropin by Powers Fasteners.
    b. Short Drop-In Anchor by Simpson Strong-Tie Co., Inc.
    c. Red Head Multi-Set II RX Short Drop-In Anchor by ITW Commercial Construction
    d. Or approved equal.

2. Usage: In precast concrete hollow core plank.

a. Zinc plated carbon steel.
b. Overhead applications in interior locations for attachment of light duty pipe and equipment supports.

c. Do not use in corrosive or humid areas, tanks, when submerged, or subjected to dynamic loads.
d. For heavy duty pipe and equipment supports or when subject to dynamic loads, use anchors that completely penetrate the plank.

2.03 FINISHES

A. Primer: Conform to requirements of Section 09960.

B. Galvanizing Repair Paint: High zinc-dust content paint complying with MIL-P-21035.

2.04 FABRICATION

A. Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.

B. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.

C. Fabricate with accurate angles and surfaces which are true to the required lines and levels, with projecting corners clipped, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

D. Weld shop connections and bolt or weld field connections.

E. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item.

1. Do not coat ferrous metal surfaces embedded in concrete.
2. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.
3. Coat aluminum surfaces in contact with concrete according to AA and Section 09960. Under no circumstances shall aluminum contact dissimilar metal.

F. Galvanizing:

1. Galvanize after fabrication.
2. Galvanize by hot-dip process conforming to ASTM A123 and AHDGA specifications.

2.05 LINTELS

A. Provide steel lintels over openings in masonry walls as noted and wherever reinforced masonry or concrete lintels are not provided.

B. Fabricate lintels from structural steel shapes as detailed, selected for straightness of section, with minimum of 8 inches bearing each side of opening.

C. Openings 4 feet and less in width without lintel scheduled, shall have double steel angle lintels or reinforced masonry lintels. Total width of horizontal legs shall be 1 inch less than nominal thickness of wall. Weld angles together. Masonry lintels shall conform to requirements of Section 04220.

2.06 METAL FRAMES

A. Provide door, hatch, grille, louver, and other frames fabricated from structural shapes or plates.
B. Select sections for trueness of web and flange. Straighten members so finished frames are uniform, square, and true throughout length and depth of assembled units.

C. Miter or cope and join members with continuous welds.

D. Provide temporary spreader bars to prevent springing frames out of shape prior to and during erection.

2.07 Miscellaneous Items

A. Fabricate miscellaneous framing, supports, and items of structural shapes, plates, bars, and tubing of sizes and arrangements indicated and as required.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. General:

1. Set work accurately into position, plumb, level, true, and free from rack.
2. Tolerance: 1/8 inch in 10 feet.
3. Anchor firmly into position.
4. Where field welding is required, comply with AWS recommended procedures for appearance and quality of weld and for methods to be used in correcting welding work.
5. Grind exposed welds smooth, and touchup shop prime coats.
6. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

7. Perform cutting, drilling, and fitting as required for proper installation. Drill field holes for bolts, do not burn holes.
8. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint the exposed areas with same material used for shop priming.

B. Concrete Anchors:

1. Do not install until concrete or masonry has reached its design strength.
2. Do not install closer than 6 bolt dia to edge of concrete or masonry, or closer than 12 bolt diameter to another anchor unless otherwise shown.
3. Minimum embedment shall be 8 bolt diameter.
4. Install according to manufacturer's recommendations.

3.03 Adjusting and Cleaning

A. Clean exposed surfaces, removing dirt, dust, and other foreign matter.

B. Prepare surfaces for finished painting as specified is Section 09960.

C. Field Repair of Damaged Galvanized Coatings:

1. Repair surfaces damaged during shipping, erection, or construction operations.
2. Use zinc rich paint.
3. Prepare surfaces and apply according to ASTM A780, Annex A2.

SECTION 06525 – FIBERGLASS REINFORCED PLASTIC GRATING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide fiberglass platforms consisting of fiberglass grating, support framing, stairs, and handrail as shown on the drawings, as specified herein, and as needed for a complete and proper installation

B. Section Includes:

1. Design, fabrication, and erection of fiberglass grating and support framing.
2. Fiberglass stair treads.
3. Fiberglass handrail.
4. System accessories.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. OSHA: Occupational Safety and Health Administration

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design Loads:

a. 100 pounds per square foot uniform live load.
b. 1000 pounds moving concentrated live load.

2. 1/4 inch maximum deflection under 100 pounds per square foot uniform live load for grating and treads.
3. L/240 maximum deflection for support members.

1.04 SUBMITTALS

A. Shop Drawings:

1. Type, layout, dimensions, fasteners, and locations.

B. Product Data:

1. Manufacturer’s literature.

C. Submit according to Section 01330.

1.05 QUALITY ASSURANCE

A. Grating shall be end product of one manufacturer to achieve standardization of appearance.

B. Handrail and railing shall meet requirements of OSHA and local building code.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide shop-fabricated grating and accessories such as frames, support angles, and fasteners.

B. Seal cut edges with compatible resin.

C. Provide fastening devices to firmly anchor grating and treads to supports. Sections designated as removable shall not be attached to supports.

1. Minimum of 4 per panel, maximum 4 feet on center.
2. Shall allow for repeated removal.
3. Minimum 1/4 inch bolts or self tapping screws.
4. 316 stainless steel or fiberglass.

D. Provide additional supports at openings in grating panels.

E. Panels shall bear on supports a minimum of 1-1/2 inches.
F. Minimum width of panels shall be 16 inches except for locations requiring a single piece.

G. Maximum width of panels shall be 60 inches.

H. Concrete anchors shall conform to requirements of Section 05500.

2.02 GRATING AND TREADS

A. Manufacturers:

1. Fibergrate Safe-T-Span.
2. DURADECK.
3. Corgrate SI.
4. Or approved equal.

B. Materials:

1. Premium polyester UV inhibited resin with continuous glass filament reinforcement.
2. Resin rich exterior surfaces free of air bubbles and dry glass.
3. Self-extinguishing according to ASTM D635.
4. Flame spread of 25 or less according to ASTM E84.

C. Provide surface with skid resistant concave profile.

D. Pultruded I-bar grating with bearing bars at 1-1/2 inches on center and cross bars at maximum 12 inches on center.

E. Treads shall have antislip nosing.

2.03 STRUCTURAL SHAPES

A. Manufacturers:

1. Dynaform by Fibergrate.
2. Pultex Series by Creative Pultrusions, Inc.
3. Extren Series by Strongwell.
4. Or approved equal.

B. Materials:

1. Pultruded fiberglass angles, channels, and other structural shapes.
2. Reinforcement shall consist of combination fiberglass roving, continuous strand, and veil material.
3. Premium polyester UV inhibited resin with surface veil on all faces.
4. Resin rich exterior surfaces free of air bubbles and dry glass.
5. Self-extinguishing according to ASTM D635.
6. Flame spread of 25 or less according to ASTM E84.

2.04 HANDRAIL

A. Manufacturers:

1. Dynarail by Fibergrate.
2. Safrail by Strongwell.
3. Corgrip by IKG/Borden.
4. Or approved equal.

B. Materials:

1. Pultruded fiberglass angles, channels, and other structural shapes.
2. Reinforcement shall consist of combination fiberglass roving, continuous strand, and veil material.
3. Premium polyester UV inhibited resin with surface veil on all faces.
4. Resin rich exterior surfaces free of air bubbles and dry glass.
5. Self-extinguishing according to ASTM D635.
6. Flame spread of 25 or less according to ASTM E84.

2.05 ACCESSORIES

A. Bolts, rivets, and other connectors shall be 316 SST.

B. Concrete anchors shall be stainless steel conforming to requirements of Section 05500.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install according to manufacturer's written instructions.

B. Clearances:

1. 1/4 inch maximum from metal sections.
2. 1/2 inch maximum from concrete or masonry walls.
3. 1/4 inch maximum between sections.

C. Seal cut edges with compatible resin.

SECTION 07210 – BUILDING INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Board insulation at perimeter concrete foundation walls.
2. Board insulation in masonry cavity walls.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

1.03 PERFORMANCE REQUIREMENTS

A. Materials of this section shall provide continuity of thermal barrier at building enclosure elements.

1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and limitations.

B. Manufacturer's installation instructions.

C. Submit according to section 01330.

1.05 ENVIRONMENTAL CONDITIONS

A. Do not install insulation adhesives when temperatures or weather conditions are detrimental to successful installation.

PART 2 - PRODUCTS

2.01 EXTRUDED POLYSTYRENE BOARD

A. Rigid, closed-cell, extruded, polystyrene insulation with integral high density skins.

B. Minimum thermal resistance "R" per inch: 5.0.

C. Minimum compressive strength:

1. 25 pounds per square inch for perimeter wall and cavity wall insulation.

D. Maximum water absorption by volume according to ASTM C272: 0.1%.

E. Manufacturer's recommended adhesive for insulation application.

F. Minimum thickness: 2 inches unless otherwise noted.

G. Acceptable Manufacturers:

1. Dow
2. Owens Corning
3. Tenneco
4. Pactiv
5. Or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION / EXTRUDED POLYSTYRENE BOARD

A. Extruded polystyrene insulation to be installed where shown on the drawings, according to manufacturer’s instructions.

B. Place boards in method to maximize contact bedding. Stagger side and end joints with edges butted tightly.

C. Cut and fit boards tightly around penetrations and other openings as required.

D. Perimeter insulation shall be set in adhesive applied to foundation wall according to manufacturer’s recommendations.

E. Cavity wall insulation shall be set in adhesive applied to exterior face of interior wythe according to manufacturer's recommendations. Fit courses of insulation between wall ties between wythes.

F. Where thickness exceeds 2 inches, install first layer of insulation as specified herein. Stagger side and end joints of finish layer.

SECTION 07531 – EPDM FULLY ADHERED ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. UL Class A fire rated single-ply EPDM fully adhered membrane roofing and flashing system as shown and herein specified.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

1.03 SUBMITTALS

A. Endorsement of Roofing Firm: System Manufacturer's endorsement of the installing firm.

B. Shop Drawings:

1. Roof insulation plan.
2. Insulation fastener pattern.
3. Base flashings.
4. Reglets.
5. Membrane terminations.

6. Roof projection flashings.
7. Sheet metal components:
8. Counterflashing.

C. Samples:

1. Roof insulation: 8 inch x 10, inch 3 pieces.
2. Insulation fastener: 3 of each.
3. EPDM membrane: 8 inch x 10 inch, 3 pieces.
4. Sheet metal components: 4 inch x 4 inch of each type, 3 pieces.

D. Product Data:

1. Vapor barrier.
2. System Manufacturer's specifications and details for roofing system.
3. Roof insulation specifications.
4. Sheet metal components.

E. Submit according to Section 01330.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. The installing contractor shall be approved or franchised by the roofing system manufacturer and shall have minimum 3 years' experience installing the selected system.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Per roofing system manufacturer's recommendations.

B. Deliver materials requiring fire resistant classifications packaged with labels intact and legible

1.06 WARRANTY

A. Roof shall be warranted for a wind speed (maximum peak gusts) of 90 miles per hour.

B. 20 year "No Dollar Limit" complete system Roofing System Manufacturer's Warranty:

1. The Manufacturer warrants to the owner that, subject to the provisions of this document, the Manufacturer will, at its own expense, make or cause to be made all repairs necessary to maintain the roofing system in a watertight condition during the 20 year period following the date of Substantial Completion of the roofing system.

a. System includes:

1) Vapor barrier.
2) Insulation.
3) Membrane.
4) Flashings.
5) Fasteners and adhesives.
6) Sheet metal components.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Provide adhesives, sealants, premolded and field fabricated flashings, fasteners, and other related components manufactured or recommended by the selected system manufacturer.

2.02 ACCEPTABLE ROOFING SYSTEM MANUFACTURERS

A. Carlisle SynTec Systems.

B. Firestone Building Products Co.

C. Or approved equal.

2.03 ACCEPTABLE SYSTEMS

A. Fully adhered minimum 0.060 inch EPDM membrane.

1. Carlisle: Design "A"
2. Firestone: Rubbergard
3. Or approved equal.

2.04 ROOF INSULATION

A. The contractor shall select a brand acceptable to the roofing system manufacturer.

B. Materials:

1. Rigid, closed-cell, polyisocyanurate insulation.
2. Minimum thermal resistance ”R” per inch: 6.0.
3. Minimum compressive strength: 20 pounds per square inch.

C. Tapered to provide minimum thickness and slopes as shown on the drawings.

2.05 INSULATION FASTENERS

A. Adhesive or mechanical fasteners as recommended by the system manufacturer.

2.06 METAL FLASHINGS

A. Counterflashing: Mill Finish aluminum roll formed reglet and counterflashing in configurations shown on the drawings and as recommended by system manufacturer. Provide metal wedge inserts in wall conterflashings. Counterflashing is required over all termination bars.

1. 2-Piece Counterflashing by Carlisle Syntec Systems, 0.040 inch.
2. 2-Piece Counterflashing by Soprema, 0.040 inch.
3. Or approved equal.

B. Fascia: Kynar 500 Finish galvanized steel, 24 gauge. Face dimension of, and in configuration, shown on the drawings and as recommended by the system manufacturer. Factory Mutual 1-90 approved.

1. SecurEdge by Carlisle Syntec Systems.
2. Sopra-Tite by Soprema.
3. Or approved equal.

C. Coping:Kynar 500 Finish galvanized steel, 24 gauge. Face dimension of, and in configuration, shown on the drawings and as recommended by the system manufacturer. Factory Mutual 1-90 approved.

1. SecurEdge by Carlisle Syntec Systems.
2. Sopra-Tite by Soprema.
3. Or approved equal.

2.07 OTHER MATERIALS

A. Wood Nailers: Pressure treated.

B. Vapor Barrier: Primer and membrane as recommended by the roofing system manufacturer.

C. Ancillary Components: System manufacturer’s standard accessory items.

PART 3 – EXECUTION

3.01 ENVIRONMENTAL CONDITIONS

A. Install roofing only in dry weather.

B. Comply with system manufacturer's climatic restrictions.

3.02 INSPECTION

A. Examine all surfaces for inadequate anchorage, foreign material, moisture, unevenness, or other conditions which could prevent the best quality and longevity of roofing, flashing, and accessory components. Notify the engineer of all deficiencies.

B. Do not proceed with the work until all deficiencies have been corrected to the satisfaction of the engineer and the roofing system manufacturer.

3.03 PREPARATION

A. Ensure that all surfaces are clean and dry before starting and during performance of work.

B. Verify that all work of other contractors and subcontractors which penetrates the roof deck or requires men and equipment to traverse the roof deck has been completed.

3.04 INSTALLATION

A. Install vapor barrier over all roof surfaces and sidewalls as recommended by the roofing system manufacturer.

B. Install the roof insulation with end joints staggered at mid-point in each layer. Offset all joints between layers a minimum of 6 inches.

1. Install adhesive adhered insulation or mechanical fasteners per system manufacturer's recommendations.
2. At penetrations, cut and fit insulation tightly to penetration.

C. Install the roofing and flashing system and all accessory items in accord with the system manufacturer's printed instructions.

D. Install all field seams using the system manufacturer's seam tape, primers, and cleaners, and in accord with the system manufacturer's recommendations. Minimum seam lap shall be 3 inches.

E. Centered over all field seams, apply a minimum 6 inch wide strip of pressure sensitive, self-adhering EPDM.

3.05 FIELD QUALITY CONTROL

A. The roofing system manufacturer shall provide onsite observation and instruction as they deem necessary.

3.06 ADJUST AND CLEAN

A. Carefully inspect all completed work and correct all defects.

B. Remove from the job site and legally dispose of all debris.

C. Prevent storage of materials and equipment on the completed roof.

SECTION 07631 – SCUPPERS AND DOWNSPOUTS
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Precoated aluminum scuppers and downspouts.
2. Precast concrete splash blocks.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association

1.03 DELIVERY. STORAGE, AND HANDLING

A. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to aid ventilation. Slope to drain.

B. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

PART 2 - PRODUCTS

1.01 MATERIALS

A. Aluminum Sheet: ASTM B209, prefinished with Kynar 500 coating of standard color as selected by owner.

2.02 COMPONENTS

A. Scuppers: Rectangular, approximately 8 inches high x 12 inches wide minimum 20 gauge, premanufactured or shop fabricated.

B. Downspouts: Rectangular, approximately 4 inch x 5 inch, minimum 24 gauge profile, corrugated type, premanufactured or shop fabricated.

C. Downspout Outlets, Downspout Straps and Support Brackets, and Down Spout Strainers to suit downspouts.

D. Splash Blocks: Precast concrete type; minimum 3000 pounds per square inch at 28 days, with a minimum of 5 percent air entrainment.

2.03 ACCESSORIES

A. Anchorage Devices: SMACNA requirements.

B. Scupper Anchors: Stainless steel.

C. Downspout Supports: Brackets or Straps, prefinished same as downspouts.

2.04 FABRICATION

A. Form scuppers and downspouts of profiles and size indicated and to SMACNA requirements.

B. Field measure site conditions prior to fabricating work.

C. Fabricate with required connection pieces.

D. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means acceptance of substrate.

3.02 INSTALLATION

A. Join lengths with formed seams sealed watertight. Flash and seal scuppers to downspouts and accessories.

SECTION 07920 – JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Preparation of joint substrates and installation of joint sealants, joint backer materials and accessories needed to ensure a complete and durable weathertight seal at locations indicated.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. NSF: National Sanitation Foundation

C. USDA: United States Department of Agriculture

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
2. Manufacturer's recommended installation procedures.
3. Catalog illustrations in sufficient detail to show installation and interface of the Work of this Section with the Work of adjacent trades.
4. Standard color card showing full range of colors available for each product exposed to view.

B. Miscellaneous:

1. Written documentation of applicator's qualifications, including reference projects of similar scope and complexity, with current phone contacts of engineers and owners for verification.
2. Certification from sealant manufacturers that their products are suitable for the use indicated and comply with specification requirements.
3. Submit according to Section 01330.

1.04 QUALITY ASSURANCE

A. Applicator shall be approved by sealant manufacturer and shall have at least three years' experience in installing materials of types specified and shall have successfully completed at least three projects of similar scope and complexity.

B. Obtain joint sealants from single manufacturer for each different product required to ensure compatibility.

1. Provide joint sealants, joint fillers and accessory joint materials that are compatible with one another and with joint substrates under Project conditions.
2. Provide joint sealants, joint fillers and related joint materials that are nonstaining to visible joint surfaces and surrounding substrate surfaces.
3. Manufacturer shall instruct applicator in procedures for intersecting sealants.

C. Perform Work according to ASTM C-1193 guidelines except where more stringent requirements are indicated or specified.

D. Schedule applications of waterproofing, water repellents, and preservative finishes after sealant installation unless sealant manufacturer approves otherwise in writing. Ensure that installed sealant is allowed to cure sufficiently prior to subsequent applications.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver the materials to Site in the manufacturer's unopened containers with all labels intact and legible at time of use.

B. Maintain the products in a dry condition during delivery, storage, handling, installation, and concealment.

1.06 SUBSTRATE CONDITIONS

A. Surfaces shall be broom clean, dry, sound, and free of voids, bugholes, rockpockets, honeycombs, protrusions, excessive roughness, foreign matter, frost, ice, and other contaminants which may inhibit application or performance of the sealant system.

B. Provide joints properly dimensioned to receive the approved sealant system.

1.07 WARRANTY

A. Furnish written warranties against adhesive and cohesive failure of the sealant and against infiltration of water and air through the sealed joint for a period of 3 years from date of substantial completion.

1. Manufacturer's standard warranty covering materials.
2. Installing Subcontractor's standard warranty covering workmanship.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Tremco.

B. Sonneborn.

C. Or approved equal.

2.02 SEALANTS

A. The sealant products listed are set as a standard of quality. Sealants of other manufacturers shall meet or exceed the characteristics of the products listed.

B. Provide colors selected by engineer from manufacturer's standard color range.

C. Sealant Type B:

1. For interior and exterior joints in vertical surfaces and non-traffic horizontal surfaces; such as:

    a. Control and expansion joints in concrete unit or brick masonry.
    b. Metal panel joints.
    c. Joints around frames of doors, windows, louvers, and other similar openings.
    d. Under metal thresholds.
    e. Joints in sheet metal flashings.
    f. Trim or finish joints.

2. Single-component or multi-component, non-sag polyurethane sealant having 25% joint movement capability that is suitable for continuous immersion in water; comply with ASTM C920, Type S or M, Grade NS, Class 25.
3. Acceptable Sealants:

    a. Tremco - Vulkem 116.
    b. Tremco – Dymeric 240/240FC

D. Sealant Type C:

1. For interior and exterior joints in horizontal and sloped traffic surfaces; such as control, expansion, and isolation joints in concrete pavement and sidewalks.
2. Single-component or multi-component polyurethane sealant having a Shore A hardness of not less than 25 or more than 50 and 25% joint movement capability that is suitable for continuous immersion in water; comply with ASTM C920, Type S or M, Grade P or NS, Class 25.

3. Acceptable Sealants:

    a. Tremco - Vulkem 45/245

E. Sealant Type H:

1. In exterior joints in horizontal concrete surfaces subject to fuel spillage.
2. Single-component or Multi-component, self-leveling, jet-fuel resistant polyurethane sealant meeting Federal Specification SS-S-200E, Type H.
3. Acceptable Sealant:

    a. Tremco - Vulkem 45SSL

2.03 ACCESSORIES

A. Joint Cleaner: As recommended by sealant manufacturer for substrates indicated.

B. Joint Primer: As recommended by sealant manufacturer for substrates, conditions and exposures indicated.

C. Bond Breaker: Polyethylene tape or other adhesive faced tape as recommended by sealant manufacturer to prevent sealant contact where it would be detrimental to sealant performance.

D. Joint Backer: Polyethylene foam rod or other compatible non-waxing, non-extruding, non-staining resilient material in dimension 25% to 50% wider than joint width as recommended by sealant manufacturer for substrates, conditions and exposures indicated.

E. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces that is suitable for masking.

F. Premolded Joint Filler: Conform to requirements of Section 03300.

2.04 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the contractor and approved by the sealant manufacturer as compatible, subject to the approval of the engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this section will be performed.

1. Verify conformance with manufacturer's requirements.
2. Report unsatisfactory conditions in writing to engineer.
3. Correct conditions detrimental to timely and proper completion of the work.
4. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Prepare surfaces to receive sealants according to sealant manufacturer's instructions and recommendations except where more stringent requirements are indicated.

B. Thoroughly clean joint surfaces using cleaners approved by sealant manufacturer whether primers are required or not.

1. Remove all traces of previous sealant and joint backer by mechanical methods, such as by cutting, grinding and wire brushing, in manner not damaging to surrounding surfaces.
2. Remove paints from joint surfaces except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer.
3. Remove wax, oil, grease, dirt, film residues, temporary protective coatings and other residues by wiping with cleaner recommended for that purpose. Use clean, white, lint-free cloths and change cloths frequently.
4. Remove dust by blowing clean with oil-free, compressed air.

C. Provide joint backer material to depth required by sealant manufacturer for proper joint design.

1. Fit securely by compressing backer material 25% to 50% so no displacement occurs during tooling.
2. Avoid stretching or twisting joint backer.

D. Provide bond-breaker where indicated or recommended by sealant manufacturer, adhering strictly to the manufacturer's installation requirements.

E. Prime joint substrates where required.

1. Use and apply primer according to sealant manufacturer's recommendations.
2. Confine primers to sealant bond surfaces; do not allow spillage or migration onto adjoining surfaces.

F. Taping:

1. Use masking tape where required to prevent sealant or primer contact with adjoining surfaces that would be permanently stained or otherwise damaged by such contact or the cleaning methods required for removal.
2. Apply tape so as not to shift readily and remove tape immediately after tooling without disturbing joint seal.

G. Premolded Joint Fillers:

1. Where expansion joints having premolded joint fillers are scheduled to be sealed, provide a reservoir to accept the sealant such as by a molded breakaway joint cap or a removable block out.
2. Joint fillers that may contact the sealant should not be impregnated with oil, bitumen, non-curing polymers or similar contaminants.

3.03 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

B. Provide the approved sealant system where shown on the drawings, and in strict accordance with the manufacturer's recommendations as approved by engineer.

C. Install sealants immediately after joint preparation.

D. Mix and apply multi-component sealants according to manufacturer's printed instructions.

E. Install sealants to fill joints completely from the back, without voids or entrapped air, using proven techniques, proper nozzles and sufficient force that result in sealants directly contacting and fully wetting joint surfaces.

F. Install sealants to uniform cross-sectional shapes with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer.

G. Tool sealants in manner that forces sealant against back of joint, ensures firm, full contact at joint interfaces and leaves a finish that is smooth, uniform and free of ridges, wrinkles, sags, air pockets and embedded impurities.

1. Dry tooling is preferred; tooling liquids that are non-staining, non-damaging to adjacent surfaces and approved by sealant manufacturer may be used if necessary when care is taken to ensure that the liquid does not contact joint surfaces before the sealant.

2. Provide concave tooled joints unless otherwise indicated to provide flush tooling or recessed tooling.
3. Provide recessed tooled joints where the outer face of substrate is irregular.

H. Remove sealant from adjacent surfaces according to sealant and substrate manufacturer's recommendations as work progresses.

I. Protect joint sealants from contact with contaminating substances and from damages. Cut out, remove and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of Substantial Completion.

SECTION 08220 – FIBERGLASS DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fiberglass reinforced plastic (FRP) doors.
2. FRP door frames.

1.02 RFERENCES

A. ASTM: American Society for Testing and Materials

B. ANSI: American National Standards Institute

1.03 SUBMITTALS

A. Product Data: Manufacturer's printed product data indicating characteristics of products specified and installation instructions.

B. Shop Drawings:

1. Dimensioned elevation of each type door assembly in project; indicate sizes and locations of door hardware, and lights and louvers, if specified.
2. Installation details of each type installation condition in project; indicate installation details of glazing, if specified.
3. Schedule: Indicate each door assembly in project; cross-reference to plans, elevations, and details. Use same designation indicated on drawings.

C. Samples: Manufacturer's standard color chips.

D. Manufacturer's standard warranty documents, executed by manufacturer's representative, countersigned by contractor.

E. Submit according to Section 01330.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Package door assemblies in manufacturer's standard containers.

B. Store door assemblies in manufacturer's standard containers, on end, to prevent damage to face corners and edges.

1.05 WARRANTY

A. Manufacturer's Lifetime warranty against failure due to corrosion from specified environment.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. FIB-R-DOR

B. CORRIM

C. Chem-Pruf

D. Or approved equal.

2.02 MATERIALS

A. Fiberglass Mat: Minimum 1.5 ounces per square foot.

B. Resins: Manufacturer's formulation for fabricating units to meet specified requirements.

C. Anchors: Manufacturer's standard stainless steel expansion anchors for existing openings, and stainless steel masonry tee anchors for new construction.

D. Fasteners: Stainless steel.

E. Glazing Type specified in Section 08800; factory installed.

2.03 DOOR AND FRAME COMPONENTS

A. Fiberglass Reinforced Plastic (FRP) Doors:

1. Thickness: 1-3/4 inches.
2. Thermal Insulating Value: R-value of 11.
3. Minimum glass fiber to resin ratio: 30%.
4. Core: End-grain balsa wood, resin-impregnated. Core at hinges, locksets, and other hardware mounting locations shall be solid fiberglass reinforced as noted and required.
5. Door Plates: Molded in one continuous piece, resin reinforced with hand-laid glass fiber mat, nominal 1/8 inch thick, minimum 15 mil gel-coated surface.
6. Door Edges: Minimum three layers resin-reinforced glass fiber mat, nominal 3/8 to 1 1/2 inch thick, machine tooled.
7. Mortise for lockset, and recess for strike plate in lock stile.
8. Embed steel reinforcement for hinges in fiberglass matrix; provide for hinge leaf recesses in hinge stile.
9. Sizes: Indicated on drawings.
10. Finish: Smooth gloss or Satin surface, minimum value 88 according to ASTM D523.
11. Color: as per engineer.

B. Fiberglass Frames: One-piece solid molded fiberglass reinforced plastic, minimum ¼ inch wall thickness.

1. Jamb-to-head joints mitered and reinforced with FRP clips and stainless steel fasteners; conforming to ANSI A250.8 requirements for performance equivalent to 16 gauge steel frames.
2. Frame profile: 5-3/4 inches deep, 2 inches wide face; double rabbeted with 5/8 inch high stop.
3. Mortise for lock strike, and recess for strike plate in lock jamb.
4. Reinforce for hinges and other indicated hardware.
5. Sizes: Indicated on drawings.
6. Finish: Smooth Gloss or Satin surface, with true and consistent color.
7. Color: to match door.

C. Lights:

1. Stops: Pultruded fiberglass reinforced plastic stops; same color as doors.
2. Sizes: Indicated on drawings.
3. Fasteners: Stainless steel screws.
4. Glass: as specified in Section 08800.

D. Frame Anchors: Types recommended by manufacturer for project conditions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that openings are correctly prepared to receive doors and frames and are correct size and depth according to shop drawings.

B. Examine conditions under which construction activities of this section are to be performed and submit written report if conditions are unacceptable.

C. Verify that glazing has been factory-installed.

3.02 INSTALLATION

A. Install door opening assemblies according to shop drawings, ANSI A250.8, and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.

B. Install of door hardware as specified in Section 08700.

C. Install door hardware according to manufacturer's printed instructions, using through-bolts to secure surface applied hardware.

D. Installation Tolerances: Maintain plumb and level tolerances specified in manufacturer's printed installation instructions.

3.03 ADJUSTING

A. Adjust doors according to door manufacturer's maintenance instructions to swing open and shut without binding, and to remain in place at any angle without being moved by gravitational influence.

B. Adjust door hardware to operate correctly according to hardware manufacturer's maintenance instructions.

3.04 CLEANING

A. Clean surfaces of door assemblies and exposed door hardware according to manufacturer's maintenance instructions.

3.05 PROTECTION

A. Protect door assemblies and door hardware from damage by subsequent construction activities until final inspection.

SECTION 08330 – SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Electrically operated exterior overhead sectional doors with steel panels of finish design.
2. Operating hardware and supports.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

1.03 QUALITY ASSURANCE

A. Provide each sectional overhead door as a complete unit produced by one manufacturer, including frames, sections, brackets, guides, tracks, counterbalance mechanisms, hardware, operators and installation accessories, to suit openings and head room allowable.

B. Wind Loading: Design and reinforce sectional overhead doors to withstand a 20 pounds per square foot wind loading pressure.

1.04 SUBMITTALS

A. Shop Drawings: Show size, window locations, support framing, jamb and head conditions, motor and operator size and locations.

B. Product Data:

1. Manufacturer’s product data, rough-in diagrams for each size and type of overhead door.
2. Manufacturer’s operating instructions and maintenance data.

C. Submit according to Section 01330.

1.05 DELIVERY, STORAGE & HANDLING

A. Deliver materials in manufacturer’s original, unopened containers.

B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.

C. Store all materials on clean raised platforms with weather protective covering when stored outdoors.

D. Provide continuous protection of materials against damage or deterioration.

E. Remove damaged or defective materials from site.

F. Comply with fire and safety regulations.

G. Follow respective manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Overhead Door Corp.

B. Gadco.

C. Wayne-Dalton Corp.

D. Windsor Door Co.

E. Or approved equal.

2.02 EXTERIOR DOORS

A. Model:

1. Overhead Door Corp. – THERMACORE 591 Series
2. Gadco – Series 8526
3. Wayne-Dalton Corp. – THERMOSPAN 200
4. Windsor Door Co. – THERM-A-GUARD Model 2600
5. Or approved equal.

B. Panels:

1. Skins: 0.016 inch hot dipped galvanized steel per ASTM A-525 and A-526 primed with factory applied rust inhibitive primer and factory finished with white baked on finish.
2. Core: Solid polyurethane.

    a. Nominal thickness: 2 inches.
    b. R-value: 14.96.

C. Tracks: Provide manufacturer's galvanized 3-inch steel track system. Provide complete track assembly including brackets, bracing and reinforcing for rigid support of ball bearing roller guides, for required door type and size. Horizontal tracks to be reinforced with continuous angle according to door size and weight.

D. Hardware: Provide heavy-duty, rust resistant hardware, with stainless steel fasteners.

E. Vision Panels: Except as otherwise indicated, furnish 24-inches by 6-inches insulated clear tempered glass vision panels in arrangement shown. Set glass in rubber or neoprene channel glazing strips for metal framed doors. Provide removable stops of same material as door section frames.

F. Hinges: Provide heavy steel hinges at each end stile and at each intermediate stile, per manufacturer's recommendations for size of door.

G. Rollers: Provide heavy-duty rollers, with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track.

H. Torsion Spring:

1. Hang door assembly for operation by torsion spring counterbalance mechanism consisting of adjustable tension tempered steel torsion springs mounted on a case-hardened steel shaft, and connected to door with stainless steel aircraft type lift cable.
2. 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, unless closer spacing recommended by door manufacturer.
3. Include a spring-loaded bronze cam mounted to bottom door roller assembly on each side, designed to stop automatically if either cable breaks. Provide either a compression spring or leaf spring bumper installed at end of each horizontal track to cushion door at end of opening operation.

I. Locks:

1. Exterior – five pin tumbler cylinder with five keys.
2. Interior – dead bolt with hole for padlock.

J. Automatic Reversing Control:

1. Furnish each door with automatic safety switch, extending full width of door bottom and located within neoprene or rubber astragal mounted to bottom door rail. Contact with switch will immediately reverse downward door travel. Furnish manufacturer's standard take-up reel or self-coiling cable.
2. Provide pneumatically actuated automatic bottom bar.

K. Weather Seals: Provide continuous rubber, neoprene or flexible vinyl adjustable weatherstrip gasket at tops and compressible astragal on bottoms of each overhead door. Provide continuous flexible seals at door jamb edges for fully weathertight installation.

L. Electrical Door Operators:

1. Furnish electric door operator assembly of size and capacity recommended and provided by door manufacturer; complete with electric motor and factory pre-wired motor controls, gear reduction unit, solenoid operated brake, clutch remote control stations and control devices.
2. Provide hand-operated disconnect or mechanism for automatically engaging sprocket chain operator and releasing brake for emergency manual operation. Include interlock device to automatically prevent motor from operating when emergency sprocket is engaged.
3. Design operator so that motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
4. Door Operator Type:

    a. Provide gear reduction trolley type, with worm, worm gear reduction, enclosed running-in-oil primary drive and chain or worm gear secondary drive, quick-clutch disconnect-release for manual operation.
    b. Electric motors: Provide high-starting torque, reversible, constant duty, Class A insulated electric motors with overload protection, sized to move door in either direction from any position, at not less than 2/3 feet per second.
    c. Coordinate wiring requirements and current characteristics of motors with building electrical system.
    d. Remote Control Station: Provide momentary contact, 3-button control station with push button controls labeled “OPEN”, “CLOSE” and “STOP”.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Carefully examine all surfaces against or into which the work will be applied. Correct all defects that would impair proper installation of products.

3.02 INSTALLATION

A. Install door, track and operating equipment complete with necessary hardware, anchors, inserts, hangers and equipment supports according to final shop drawings, manufacturer’s instructions and as herein specified.

B. Fasten vertical track assembly to framing at not less than 24 inches on center. Hang horizontal track from structural overhead framing with angle or channel hangers, welded and bolt-fastened in place. Provide sway bracing, diagonal bracing and reinforcing as required for rigid installation of track and door operating equipment.

C. Upon completion of installation, lubricate, test and adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.03 CLEAN-UP

A. Upon completion of work, carefully inspect all exposed surfaces. Clean and provide touch-up finish. Leave all surfaces clean and free from all paint, stains, spatterings, smears and smudges resulting from general work.

B. Remove all scaffolding, tools, equipment, and temporary protection. Remove all surplus materials, containers, debris and rubbish resulting from operations and legally dispose off site.

SECTION 08700 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Hardware for fiberglass doors.

1.02 REFERENCES

A. NEMA: National Electrical Manufacture’s Association

1.03 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacturing door hardware with minimum three years’ experience.

1.04 SUBMITTALS

A. Shop Drawings.

B. Product Data.

C. Submit according to Section 01330.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

B. Protect hardware from theft by cataloging and storing in secure area.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Locksets.

1. Entrance Lockset x lever action x stainless steel x US 32D x removable core x Box Strike.

a. L9453 x 03	Schlage
b. 8847 x CRE	Yale
c. ML2048 x LSM	Corbin Russwin
d. 3853 x William	Hager
e. Or approved equal.	

B. Exit Devices: Rim type x stainless steel x US 32D. Provide compatible F08 heavy duty exit device trim for exterior doors and compatible passage type exit device trim for interior doors.

1. Single doors:

a. ED5200	Corbin Russwin
b. 8300	Adams Rite
c. Or approved equal.	

C. Hinges x 4-1/2 x 4-1/2 x US 32D.

1. BB 1191	Hager
2. FBB 191	Stanley
3. BB 4101	Lawrence
4. Or approved equal.	

E. Closers x delayed action x AL - size as recommended by manufacturer. Install closers on room side, using parallel arms where necessary.

1. DC6000 Series	Corbin Russwin
2. 4010 / 4110 Smoothee Series	LCN
3. 7500 Series	Norton
4. 5100 Series	Hager
5. Or approved equal.	

HO - indicates hold open

F. Kick Plates – 10 inch x 2 inch LDW x US 32D x 16GA.

1. Brookline
2. Ives
3. Hiawatha
4. Rockwood
5. Or approved equal.

G. Thresholds - set in sealant 5 inch x 1/2 inch Clear Anodized Aluminum Thermally Broken Saddle x frame width.

1. S282A x AL	Reese
2. 252 x 3AFG x AL	Pemko
3. 8425 x AL	National Guard
4. 421S x AL	Hager
5. Or approved equal.	

I. Door Bottom - Mill Aluminum with thermoplastic rubber.

1. DB594AU	Reese
2. 222APK	Pemko
3. 15NA	National Guard
4. 779SNMIL	Hager
5. Or approved equal.	

J. Weatherstrip – Clear Anodized Aluminum.

1. DS 69C	Reese
2. 110 NA	National Guard
3. 332 CR	Pemko
4. 873SNMIL	Hager
5. Or approved equal.	

M. Overhead Stop – Hold Open.

1. 70H x 26	Glynn Johnson

2.02 KEYING

A. Key according to schedule provided by owner.

B. Supply 5 keys for each lock.

C. Cylinder locks on doors to match existing master keying.

2.03 FINISHES

A. Manufacturer responsible for surface preparation and priming. Finish coating of doors either in plant or field. System shall comply with Section 09960, refer to Schedule. Coordinate finish color with engineer.

B. Finishes are US 32 satin stainless steel unless otherwise noted. Closer finishes may be paint.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install hardware according to manufacturer's instructions.

B. Use the templates provided by hardware item manufacturer.

3.03 HARDWARE SCHEDULE

A. Set No. 5.
1-1/2 PR Butts x NRP
1 Entrance Lockset
1 Closer x 110 degrees x HO
1 Kickplate
1 Weatherstripping
1 Door Bottom
1 Threshold

SECTION 08800 – GLASS AND GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Exterior doors.

1.02 REFERENCES

A. ASTM: American Society for Testing and Materials

B. ANSI: American National Standards Institute

1.03 QUALITY ASSURANCE

A. Safety Glass: Comply with ANSI Z97.1, with label on each piece.

B. Safety Glazing Materials Act.

1.04 SUBMITTALS

A. Manufacturer's Data, Glass:

1. Manufacturer's specifications and installation instructions for each type of glass required.
2. Include test data substantiating that glass complies with specified requirements.

B. Manufacturer's Data, Glazing Materials:

1. Manufacturer's specifications and installation instructions for each type of glazing sealant and compound, gasket and associated miscellaneous material. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the project specifications and is suitable for the applications shown.

C. Samples, Glass:

1. Submit 3, samples of each type of glass specified.
2. Insulating glass samples need not be hermetically sealed, but edge construction shall be included.

1.05 JOB CONDITIONS

A. Weather Conditions: Do not proceed with installation of liquid sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.

1.06 GUARANTEES

A. Insulating Glass: Provide manufacturer's ten year warranty against seal separation.

PART 2 - PRODUCTS

2.01 GLASS TYPES

A. Type G5: 1 inch thick overall insulating glass units, with makeup of 1/4 inch annealed float outboard glass, 1/2 inch thick dead air space, and 1/4 inc clear annealed float inboard glass with clear pyrolitic low-emissivity coating on #3 surface within unit.

2.02 GLAZING SEALANTS/COMPOUNDS

A. Preformed Butyl Rubber Glazing Sealant:

1. Tape or ribbon (coiled on release paper) of polymerized butyl, of mixture of butyl and polyisobutylene, compounded with inert fillers and pigments, solvent based with minimum of 95% solids, with thread of fabric reinforcement, tack-free within 24 hours, paintable, non-staining.
2. Provide combination tape and encased continuous rubber shim, of approximately 50 durometer hardness.
3. Any caulkings or window sealants which come in contact with the insulating glass sealants are to be compatible.

2.03 GLAZING GASKETS

A. Provide glazing gaskets recommended by manufacturer.

B. Molded Neoprene Glazing Gaskets:

1. Molded or extruded neoprene gaskets or profile and hardness shown for watertight construction; comply with ASTM D2000 designation 2BC 415 to 3BC 620, black.

C. Polyvinyl Chloride Glazing Gaskets:

1. Extruded, flexible PVC gaskets of the profile and hardness shown; when not shown, for watertight construction comply with ASTM D2287.

D. Vinyl Foam Glazing Tape:

4. Closed cell, flexible, self adhesive, non-extruding, polyvinyl chloride foam tape; recommended by manufacturer for exterior, exposed, watertight, installation of glass, with only nominal pressure in the glazing channel, comply with ASTM D1667.

2.04 MISCELLANEOUS GLAZING MATERIALS

A. Setting Blocks: Neoprene, 70-90 durometer hardness, with proven compatibility with sealants used.

B. Spacers: Neoprene 40-50 durometer hardness, with proven compatibility with sealants used.

C. Compressible Filler Rod: Closed cell or waterproof jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 510 pounds per square inch compression strength for 25% deflection.

D. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the framing and glazing channel surfaces, backing, removable stop design, and the conditions under which the glazing will be performed, and notify the engineer in writing of all conditions detrimental to the proper and timely completion of the work. Do not proceed with the glazing until unsatisfactory conditions have been corrected in a manner acceptable to the engineer.

3.02 JOB REQUIREMENTS

A. Provide watertight and airtight installation of each piece of glass. Each installation shall withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

B. Protect glass from edge damage at all times during handling, installation and operation of the building.

C. Glazing channel dimensions shown provide for a minimum bite on the glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. Be responsible for correct glass size for each opening, within the tolerances and dimensions established.

D. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representative direct otherwise.

E. Comply with "Glazing Manual" by Flat Glass Marketing Associating except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.

F. Inspect each piece of glass immediately before installation, and eliminate all which have observable edge damage or face imperfections.

G. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.

3.03 PREPARATION FOR GLAZING

A. Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

B. Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

3.04 GLAZING

A. Comply with ANSI Standard Z97.1-1975 Safety Glazing Code.

B. Install setting blocks of proper size at quarter points of sill rabbet. Set blocks in thin course of the heelbead compound.

C. Glazing shall be set with equal bearing for entire width.

D. Provide spacers inside and out, and of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

E. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channels at the heel of jambs and bead (do not leave voids in the sill channels) except as otherwise indicated, depending on light size, thickness and type of glass, and complying with manufacturer's recommendations.

F. Do not attempt to cut, seam, nip or abrade glass which is chemically strengthened, tempered, or heat strengthened.

G. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

H. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel to eliminate dirt and moisture pockets.

I. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.

J. Where wedge shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesive, including embedment of gasket tail in cured heel bead.

3.05 CURE, PROTECTION AND CLEANING

A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

B. Protect exterior glass from breakage immediately upon installation by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.

C. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during the construction period, including natural causes, accidents and vandalism.

D. Maintain glass in a reasonably clean condition during construction so that it will not be damaged by corrosive action and will not contribute (by washoff) to the deterioration of glazing materials and other work.

E. Wash and polish glass on both faces not more than four days prior to acceptance of the work in each area. Comply with glass manufacturer's recommendations. Washing shall be done by professional firm.

SECTION 09960 – COATINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Coating of surfaces as specified herein, including:

1. New and existing surfaces described in notes on Drawings.

2. Exposed interior and exterior ferrous metal, ductile iron, or cast iron piping, regardless of factory-applied finish.
3. Exposed interior and exterior structural steel surfaces.
4. Exterior and interior equipment, pumps, valves, motors, etc. and all appurtenances.
5. Steel doors and frames.

B. Do not coat the following unless specifically noted otherwise:

1. Factory-finished electrical motor control panels (MCC), main instrument panels (MIP), flow indicators, and related equipment.
2. Moving parts of operating units, electrical parts, linkages, sensing devices, and motor shafts.
3. Buried equipment and piping.
4. Factory-finished trim.
5. Stainless steel, chrome plate, copper, bronze, galvanized surfaces, and similar finished materials.
6. Aluminum ductwork or aluminum faced insulation.
7. Aluminum louvers and trim.
8. Concrete tanks.
9. Plastic and FRP piping, equipment, and ductwork.

C. Do not coat over any code-required labels such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

D. Equipment manufacturers are responsible for surface preparation and coating of equipment, motors, and appurtenances. Equipment to be coated and coating system is identified in the equipment specification sections.

1.02 DEFINITIONS

A. Definitions as used in Coating Schedule included herein.

1. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, splash, or chemical environment, including primers, sealers, fillers, and intermediate and finished coats.
2. First Coat: Field primer, factory primer, or shop primer. When only one coat is required, first coat is the finished coat.
3. Second, Third, or Intermediate Coats: Successive finished coats applied over first coat.
4. DFT: Dry film thickness (mils/coat).
5. sfpg: Square feet per gallon (per coat).

1.03 REFERENCES

A. MSDS: Material Safety Data Sheets

B. ASTM: American Society for Testing and Materials

C. SSPC: The Society for Protective Coatings

D. OSHA: Occupational Safety and Health Administration

E. NSF: National Sanitation Foundation

1.04 SUBMITTALS

A. Product Data:

1. Manufacturer's literature including application recommendations and generic makeup for each coating scheduled.
2. Factory or shop-applied primer manufacturer's literature including application recommendations and generic makeup shall be submitted with all material and equipment submittals. All primers shall conform to the requirements of this Section.

B. Samples:

1. Actual color samples available for each coating scheduled.

C. Miscellaneous:

1. Schedules:

a. Schedule of proposed coating systems within 60 days after Notice to Proceed.
b. Schedule of proposed coating systems shall contain all information as indicated in Coating Schedule included herein.

2. Submit one copy of manufacturer's MSDS, for each type of coating, to engineer's field office for information. Contractor shall post copy of MSDS on Site at all times coating is in progress.

D. Submit according to Section 01330.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:

1. All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.

B. Applicator Qualifications:

1. Engage an experienced field applicator with a minimum of 5 yrs successful experience and who has successfully completed coating system applications similar in material and extent to those indicated.

C. Single-Scource Responsibility:

1. Provide coating material produced by same manufacturer for each system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to site in original containers with labels intact and seals unbroken.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 55° F.

C. Avoid danger of fire. Oily rags and waste must be removed from buildings each night or kept in appropriate metal containers. Provide fire extinguishers of type recommended by coating manufacturer’s in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.

D. Empty containers shall have labels canceled and clearly marked as to use.

1.07 PROJECT / SITE CONDITIONS

A. Environmental Requirements:

1. Dry-heat and ventilate areas to obtain conditions recommended by coating manufacturer.
2. Relative humidity conditions as specified by coating manufacturer shall be adhered to.
3. No unprotected, unheated exterior coating shall be undertaken when cold, damp, foggy, or rainy weather appears probable, nor when the temperature of the substrate is below 55° F, unless approved in writing by coating manufacturer.

4. Maintain manufacturer's environmental requirements until coating is fully cured.
5. Apply no coating in areas where dust is being generated.
6. Testing and disposal of any waste and coating shall be the responsibility of the Contactor.

B. Protection:

1. Drop cloths shall be provided in all areas where coating is done to fully protect other surfaces.
2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide protection by masking. Upon completion, replace items or remove protection and clean.

C. It is the intent of this Section that all ferrous metal items scheduled for coating be shop-primed. If items are not shop-primed, surfaces shall be prepared and coated in the field as specified.

D. Upon Substantial Completion, remaining unused material will become property of owner. Seal material as required for storage, mark contents with color, type, location, and shelf life, and store on Site where required by owner. Provide minimum of two gallons of each system component and color used.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Tnemec.

B. Sherwin Williams

C. Rust-Oleum

D. Or approved equal.

2.02 MATERIALS

A. Coatings shall meet surface burning characteristics as required by code and established by ASTM E84.

B. Coating products of Tnemec, listed in the Coating Schedule, are set as a standard of quality. Coatings of substitute manufacturers shall meet or exceed the characteristics of the products listed as established by the flowing ASTM standards; B117, C307, C413, C579, C580, C868, D870, D1014, D1653, D2047, D2240, D2370, D2794, D3363, D4060, D4141, D4541, D4585, D4587, and G85.

C. The contractor and top coat coating manufacturer shall verify the compatibility of their products with the various primers used on shop primed materials and equipment.

2.03 COLORS

A. Color shall be formed of pigments free of lead, lead compounds, or other materials which might be affected by presence of hydrogen sulfide or other gases likely to be present at Site.

B. Colors shall be as selected by owner.

2.04 THINNING, MIXING, AND TINTING

A. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with coating manufacturer's recommendations.

B. Mix according to manufacturer's recommendations.

C. Each coat shall be slightly darker than preceding coat, unless otherwise noted. Tint undercoats similar to finish coat.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Materials removed and replaced to correct defects due to Work placed on unsuitable surfaces shall be at contractor's expense.

3.02 SURFACE PREPARATION

A. General:

1. All surfaces to be coated shall be prepared as specified herein and according to coating manufacturer's recommendations. The object shall be to obtain a uniform, clean, and dry surface.
2. Quality of surface preparation described herein is considered a minimum. If coating manufacturer requires a higher degree of preparation, comply with coating manufacturer's recommendations.
3. Where surface dryness is questioned, test with dampness indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted by coating manufacturer.
4. Shop primed surfaces shall be scarified before applying top coats. Conform to top coat manufacturers recommendations.

5. If recoat time between application of primer and second coat or between top coats is exceeded, scarify surface before applying coatings. Conform to top coat manufacturers recommendations.
6. Workmanship for surface preparation shall conform to the following SSPC specifications:

    a. Solvent Clean: SP-1.
    b. Hand Tool Cleaning: SP-2.
    c. Power Tool Cleaning: SP-3.
    d. White Metal Blast Cleaning: SP-5.
    e. Commercial Blast Cleaning: SP-6.
    f. Brush-Off Blast Cleaning: SP-7.
    g. Pickling: SP-8.
    h. Near-White Blast Cleaning: SP-10.
    i. Power Tool Cleaning to Bare Metal: SP-11.
    j. Surface Preparation by Water Jetting: SP-12.
    k. Surface Preparation of Concrete: SP-13.
    l. Industrial Blast Cleaning: SP-14.
    m. Commercial Grade Power Tool Cleaning: SP-15.
    n. Brush-Off Blast Cleaning of Non-Ferris Metals: SP-16

B. Ferrous Metal:

1. Ferrous metal primed in the shop shall have all rust, dust, scale, and other foreign substances removed by abrasive cleaning conforming to SSPC SP-10. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting.
2. Ferrous metal not primed in the shop shall be abrasive blast cleaned in the field prior to application of primer, pretreatment, or coating. Blast cleaning shall conform to SSPC SP-10 for submerged service. Blast cleaning shall conform to SSPC SP-6 for non-submerged service.
3. Prior to finish coating, primed areas that are damaged shall be cleaned and spot primed.

C. Galvanized Metal:

1. Galvanized metal items shall be abrasive sweep blast cleaned and then solvent cleaned according to SSPC SP-1.

D. Copper:

1. Copper piping shall be lightly sanded and then solvent cleaned according to SSPC SP-1.

E. Aluminum:

1. Aluminum shall be lightly sanded and then solvent cleaned according to SSPC SP-1.

3.03 APPLICATION

A. Surfaces shall be dry at time of application.

B. The minimum surface temperature shall be 55°F and rising. Some coatings are modified so that they may be applied at lower temperatures, conform to manufacturer's recommendations.

C. Apply in strict accordance with manufacturer's recommendations by brush, roller, spray, or other application method. The number of coats and thickness required is the same regardless of application method.

D. Each coat shall be allowed to dry according to manufacturer's requirements. Drying time shall be construed to mean "under normal conditions". Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary. Units shall not be put in service until coatings are thoroughly dry and cured.

E. Surfaces to be coated that will be inaccessible in the completed work shall receive the final coat before enclosure.

F. Coatings shall be applied to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable. Areas cut-in by brush prior to rolling shall have uniform appearance in comparison with adjoining surfaces.

G. Make edges of coating adjoining other materials or colors sharp and clean without overlapping.

H. Crevices and other hard-to-apply areas shall be back-rolled/back-brushed in conjunction with application of field applied prime coat or intermediate coat. This includes, but is not limited to: between pipe flanges, pipe flange/barrel joints, equipment fittings, and other narrow openings.

I. Finish edges of doors as specified for faces. Apply first finish coat on edges before fitting. After doors fitted and hung apply second finish coat.

J. Manufacturer-Applied Coatings:

1. Repair abraded areas on factory-finished items according to equipment manufacturer's recommendations.
2. Blend repaired areas into original finish.

3.04 FIELD QUALITY CONTROL

A. Examination of Work on Site by coating manufacturer's representative shall be performed when requested by engineer.

B. Sampling of Materials:

1. Engineer reserves the right to select unopened containers of materials furnished for the Project and have the materials tested at an independent laboratory. Owner will pay for first tests.
2. Retests of rejected materials and tests of replacement materials shall be paid for by contractor.
3. Remainder of contents of containers not required for testing will be returned to contractor.

C. Coverage:

1. Before beginning Work, finish one complete room, space, surface, and item of each color scheme required, showing selected colors, finished texture, material, and workmanship. After approval, sample room, space, surface, and item shall serve as standard for similar Work.
2. If coverage is not acceptable to engineer, engineer reserves the right to require additional application of coating at no extra cost to owner.

D. Where coatings are to be applied at the Site, engineer reserves the right to observe the Work. After surface has been prepared and before application of specified prime coat and each succeeding finish coat, contractor shall provide three days' notice to engineer to allow the engineer time to observe the Work. If notification is not provided, no credit for applied coat will be given and contractor automatically assumes responsibility to recoat Work in question. Surfaces coated without notification shall be abrasive blast cleaned, re-prepared, and recoated at no addition cost to owner.

1.05 FINAL TOUCH-UP AND CLEANING

A. Prior to Substantial completion, examine coated surfaces and retouch or refinish surfaces to leave in condition acceptable to engineer.

B. Remove masking, coatings, and other material from floors, glass, and other surfaces not scheduled to be coated.

1.06 COATING SCHEDULE

A. Scheduled thickness or coverage rate is minimum as recommended by Tnemec. If other manufacturer is used, manufacturer's recommendations shall be followed, but in no case shall the thickness or coverage rate be less than scheduled.

B. Coatings shall conform to the following schedule and coating manufacturer's recommendations. Examples of surfaces to be coated may not be all inclusive.

COATINGS SCHEDULE

System No.	Generic Type	Application	Coating
7	Modified Aromatic Polyurethane - Polyamidoamine Epoxy	Ferrous Metal, Cast Iron, Ductile Iron / Submerged NP / Satin	First Coat – Series 1 @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 @ 5 mils DFT Third Coat – Series N69 @ 5 mils DFT
8	Modified Aromatic Polyurethane - Polyamidoamine Epoxy	Ferrous Metal, Cast Iron, Ductile Iron / Interior Non-Submerged / Satin	First Coat – Series 1 @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 @ 5 mils DFT Third Coat – Series N69 @ 5 mils DFT
9	Modified Aromatic Polyurethane - Polyamidoamine Epoxy – Aliphatic Acrylic Polyurethane	Ferrous Metal, Cast Iron, Ductile Iron / Exterior Non-Submerged / Gloss	First Coat – Series 1 @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 @ 5 mils DFT Third Coat – Series 1074 @ 3 mils DFT
10	Polyamide Epoxy – Polyamidoamine Epoxy	Doors, Frames, Motors and other Equipment with Non-Epoxy Primer / Interior / Satin	Lightly Hand Sand Solvent Clean SP-1 First Coat – Series 27-1255 Beige @ 3 mils DFT Second Coat – Series N69 @ 5 mils DFT
11	Polyamide Epoxy – Aliphatic Acrylic Polyurethane	Doors, Frames, Motors and other Equipment with Non-Epoxy Primer / Exterior / Gloss	Lightly Hand Sand Solvent Clean SP-1 First Coat – Series 27-1255 Beige @ 3 mils DFT Second Coat – Series 1074 @ 3 mils DFT

System No.	Generic Type	Application	Coating
12	Polyamidoamine Epoxy	Galvanized Metal, Copper, PVC / Non-Submerged / Interior / Satin	First Coat – Series N69-1255 Beige @ 2 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 @ 3 mils DFT Third Coat – Series N69 @ 3 mils DFT
13	Polyamidoamine Epoxy – Aliphatic Acrylic Polyurethane	Galvanized Metal, Copper, PVC / Non-Submerged / Exterior / Gloss	First Coat – Series N69-1255 Beige @ 2 mils DFT, touch-up primer prior to second coat Second Coat – Series N69 @ 3 mils DFT Third Coat – Series 1074 @ 3 mils DFT
20	Polyamide Epoxy Coal Tar	Dissimilar Metal Protection / Semi-Gloss	Scarify the Surface, SP-1 First Coat – Series 46H-413 @ 20 mils DFT
22	Zinc-Rich Aromatic Urethane – Polyamidoamine Epoxy	Ferrous Metal / Interior Non-Submerged / Submerged NP / Satin (Do Not Use on Ductile Iron)	First Coat – Series 90-97 @ 3 mils DFT Second Coat – Series N69 @ 5 mils DFT Third Coat – Series N69 @ 5 mils DFT
23	Zinc-Rich Aromatic Urethane – Polyamidoamine Epoxy – Aliphatic Acrylic Polyurethane	Ferrous Metal / Exterior Non-Submerged / Gloss (Do Not Use on Ductile Iron)	First Coat – Series 90-97 @ 3 mils DFT Second Coat – Series N69 @ 5 mils DFT Third Coat – Series 1074 @ 3 mils DFT
25	Vinyl Ester	Ferrous Metal, Cast Iron, Ductile Iron / Interior Non-Submerged / Submerged NP / Satin	SSPC SP-5 with min 3 mil profile First Coat – Series 120-5002 @ 12-18 mils DFT Second Coat – Series 120-5001 @ 12-18 mils DFT

Foot Notes:

1. Where an Alternative System No. (ALT) is noted the contractor may substitute the ALT system when approved by the engineer. If the ALT system is used, it shall be used for all work covered by that system.
2. Series N69 may be substituted for Series 1.

20. Brining Building Plumbing, Item SPV.0105.04.

A Description
This special provision describes providing the plumbing construction required to complete the Brining Building 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 Brining Building Plumbing by the lump sum, completed according to the contract and accepted, as a single complete unit of work.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.04	Brining Building Plumbing	LS

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

INDEX OF PLUMBING SPECIFICATIONS

SECTION 15400 BASIC PLUMBING MATERIALS AND METHODS

GENERAL

SUMMARY

This section includes the following:
Piping materials and installation instructions common to most piping systems.
Transition fittings.
Dielectric fittings.

Mechanical sleeve seals.
Sleeves.
Escutcheons.
Equipment installation requirements common to equipment sections.
Painting and finishing.
Supports and anchorages.

DEFINITIONS

Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

The following are industry abbreviations for plastic materials:
ABS: Acrylonitrile-butadiene-styrene plastic.
CPVC: Chlorinated polyvinyl chloride plastic.
PE: Polyethylene plastic.
PVC: Polyvinyl chloride plastic.

The following are industry abbreviations for rubber materials:
EPDM: Ethylene-propylene-diene terpolymer rubber.
NBR: Acrylonitrile-butadiene rubber.

QUALITY ASSURANCE

Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

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.

DELIVERY, STORAGE, AND HANDLING

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.

Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

COORDINATION

Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces

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.

Conflicts between Trades: Resolve all conflicts with other trades at no additional cost to the owner or engineer.

INTENT OF DRAWINGS AND SPECIFICATIONS

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.

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 engineer and/or established by manufacturer's installation drawings and details.

The contractor shall refer to shop drawings and submittal drawings for all equipment requiring plumbing connections to verify rough-in and connection locations.

Unless specifically stated to the contrary, no measurement of an 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.

DRAWINGS

The plumbing drawings do not attempt to show the complete details of building construction, which affect the plumbing installation. The contractor shall refer to the architectural, civil, structural and mechanical, and electrical drawings for additional details, which affect the proper installation of this work. Bring any discrepancies to the attention of the engineer 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.

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.

MATERIAL AND EQUIPMENT

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.

COOPERATION WITH OTHER TRADES

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.

CUTTING AND PATCHING

As necessary and with approval to permit the installation of piping or any part of the work under this branch. Any cost caused by defective or ill-timed work shall be by the party responsible there for. Patching of holes, openings, etc. resulting from the work of this branch shall be furnished by this contractor.

STANDARDS, CODES AND PERMITS

All work shall be installed according to National, State and Local plumbing codes, laws, ordinances and regulations. Comply with all applicable OSHA regulations.

All materials shall have a U.L. label where a U.L. standard and/or test exists.

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.

WORKMANSHIP

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.

DRAWINGS OF OTHER TRADES

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.

FIELD MEASUREMENTS

The contractor shall take all field measurements necessary for his work and shall assume the full responsibility for their accuracy.

STRUCTURAL INTERFERENCES

Should any structural interference prevent the installation of the fixtures, running of piping, etc., at points shown on drawings, the necessary minor deviation there from, as determined by the engineer, may be permitted. Minor changes in the position of the fixtures, equipment or piping if decided upon before any work has been done by the contractor shall be made without additional charge.

PRODUCTS

MANUFACTURERS

In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

PIPE, TUBE, AND FITTINGS

Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

JOINING MATERIALS

Refer to individual Division 15 piping Sections for special joining materials not listed below.

Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

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.

Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

TRANSITION FITTINGS

AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

Manufacturers:

Cascade Waterworks Mfg. Co.
Dresser Industries, Inc.; DMD Div.
Ford Meter Box Company, Incorporated (The); Pipe Products Div.
Viking Johnson
Or approved equal.

Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.

Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.

Aboveground Pressure Piping: Pipe fitting.

Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

Manufacturers:

Eslon Thermoplastics
Spears Manufacturing
Or approved equal.

Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

Manufacturers:

NIBCO INC.
Spears Manufacturing
Or approved equal.

Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

Manufacturers:

Cascade Waterworks Mfg. Co.
Fernco, Inc.
Mission Rubber Company
Plastic Oddities, Inc.
Or approved equal.

DIELECTRIC FITTINGS

Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

Insulating Material: Suitable for system fluid, pressure, and temperature.

Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

Manufacturers:
- Eclipse, Inc.
- Epco Sales, Inc.
- Hart Industries, International, Inc.
- Watts Industries, Inc.; Water Products Div.
- Zurn Industries, Inc.; Wilkins Div.
- Or approved equal.

Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

Manufacturers:
- Calpico, Inc.
- Lochinvar Corp.
- Or approved equal.

Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

Manufacturers:
- Precision Plumbing Products, Inc.
- Sioux Chief Manufacturing Co., Inc.
- Victaulic Co. of America
- Or approved equal.

MECHANICAL SLEEVE SEALS

Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

Manufacturers:
- Advance Products & Systems, Inc.
- Calpico, Inc.
- Metraflex Co.
- Pipeline Seal and Insulator, Inc.
- Or approved equal.

Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

Pressure Plates: Stainless steel. Include two for each sealing element.

Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

SLEEVES

Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
Underdeck Clamp: Clamping ring with setscrews.

PVC Pipe: ASTM D 1785, Schedule 40.

ESCUTCHEONS

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.

One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

One-Piece, Cast-Brass Type: With set screw, polished chrome-plated or rough brass finish.

Split-Casting, Cast-Brass Type: With concealed hinge and set screw, polished chrome-plated or rough brass finish.

One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

Split-Plate, Stamped-Steel Type: With hinge, set screw or spring clips, and chrome-plated finish.

One-Piece, Floor-Plate Type: Cast-iron floor plate.

Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

EXECUTION

PIPING SYSTEMS - COMMON REQUIREMENTS

Install piping according to the following requirements and Division 15 Sections specifying piping systems.

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.

Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

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.

Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

Install piping to permit valve servicing.

Install piping at indicated slopes.

Install piping free of sags and bends.

Install fittings for changes in direction and branch connections.

Install piping to allow application of insulation.

Select system components with pressure rating equal to or greater than system operating pressure.

Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

New Piping:

Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

Insulated Piping: One-piece, stamped-steel type with spring clips.

Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.

Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.

Bare Piping in Equipment Rooms: One-piece, cast-brass type.

Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

Existing Piping: Use the following:

Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.

Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.

Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.

Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

Sleeves are not required for core-drilled holes.

Permanent sleeves are not required for holes formed by removable PE sleeves.

Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

Cut sleeves to length for mounting flush with both surfaces.

Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

Install sleeves in new walls and slabs as new walls and slabs are constructed.
Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
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 (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
Seal space outside of sleeve fittings with grout.
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 "Joint Sealants" for materials and installation.

Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
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.

Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
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.

Verify final equipment locations for roughing-in.

Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

PIPING JOINT CONSTRUCTION

Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

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.

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.

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:

Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

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.

Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

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.

PVC Nonpressure Piping: Join according to ASTM D 2855.

Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

PIPING CONNECTIONS

Make connections according to the following, unless otherwise indicated:

Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

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.

Install equipment to allow right-of-way for piping installed at required slope.

PAINTING

Painting of plumbing systems, equipment, and components is specified in Division 9 Section "."

Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

ERECTION OF METAL SUPPORTS AND ANCHORAGES

Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
Field Welding: Comply with AWS D1.1.

SECTION 1540 PLUMBING HANGERS AND SUPPORTS

PART 1 - GENERAL

SUMMARY

This Section includes hangers and supports for plumbing system piping and equipment.

DEFINITIONS

MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

PERFORMANCE REQUIREMENTS

Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

QUALITY ASSURANCE

Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
B-Line Systems, Inc.
Globe Pipe Hanger Products, Inc.
Grinnell Corp.
GS Metals Corp.
National Pipe Hanger Corp.
Or approved equal.

GENERAL

Provide support, anchors compatible with atmosphere where located. For applications associated with this project which are located in Salt Storage buildings and Salt Brining Rooms, these areas are to be considered corrosive atmospheres. Use Stainless Steel version of hanger model and type listed in this Section. Also utilize Stainless or non-metallic version of Uni-strut material.

MANUFACTURED UNITS

General: All Supports and Hangers used in General locations shall be Stainless Steel.

Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
Stainless Steel: For all general locations.
Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
Stainless Steel: For piping and equipment that is located in corrosive areas.

Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
Stainless Steel: For piping and equipment that is located in corrosive areas.

Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.
Material: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

EXECUTION

HANGER AND SUPPORT APPLICATIONS

Specific hanger requirements are specified in Sections specifying equipment and systems.

Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types, utilizing Stainless steel version of the types listed:
- Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of uninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
- 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.
- 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.
- Adjustable Steel Band Hangers (MSS Type 7): For suspension of uninsulated stationary pipes, NPS 1/2 to NPS 8.
- Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of uninsulated stationary pipes, NPS 1/2 to NPS 2.
- Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of uninsulated stationary pipes, NPS 3/8 to NPS 8.
- U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
- Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
- Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
- Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
- Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
- Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
- Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
- Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.

Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

HANGER AND SUPPORT INSTALLATION

Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
Field assemble and install according to manufacturer's written instructions.

Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
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.
Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

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.

Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

Insulated Piping: Comply with the following:

Attach clamps and spacers to piping.

Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

Do not exceed pipe stress limits according to ASME B31.9.

Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

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.

Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

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.

Shield Dimensions for Pipe: Not less than the following:

NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

Insert Material: Length at least as long as protective shield.

Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

EQUIPMENT SUPPORTS

Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

Grouting: Place grout under supports for equipment and make smooth bearing surface.

METAL FABRICATION

Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

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:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove welding flux immediately.

Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

ADJUSTING

Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

PAINTING

Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

SECTION 15407 PLUMBING IDENTIFICATION

PART 1 - GENERAL

SUMMARY

This section includes the following plumbing identification materials and their installation:

- Pipe markers
- Stencils
- Valve tags
- Warning tags

QUALITY ASSURANCE

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.

COORDINATION

Coordinate final color coding of piping and labeling with Process identification scheme.

Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

Coordinate installation of identifying devices with location of access panels and doors.

Install identifying devices before installing acoustical ceilings and similar concealment.

PRODUCTS

PIPING IDENTIFICATION DEVICES

Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

Colors: Comply with ASME A13.1, unless otherwise indicated.

Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.

Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4-inch minimum.
Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

VALVE TAGS

Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by engineer. Provide 5/32-inch hole for fastener.
Material: 0.032-inch- thick brass or aluminum.
Valve-Tag Fasteners: Brass wire-link or beaded chain.

WARNING TAGS

Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
Size: 3 by 5-1/4 inches minimum.
Fasteners: Reinforced grommet and wire or string.
Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
Color: Yellow background with black lettering.

EXECUTION

APPLICATIONS, GENERAL

Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

PIPING IDENTIFICATION

Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.

Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

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 non-concealed locations as follows:
Near each valve.
Near each branch connection, excluding short branches for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
At access doors, manholes, and similar access points that permit view of concealed piping.
Near major equipment items and other points of origination and termination.
Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

VALVE-TAG INSTALLATION

Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; faucets; convenience and lawn-watering hose connections. List tagged valves in a valve schedule.

Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme.

WARNING-TAG INSTALLATION

Write required message on, and attach warning tags to, equipment and other items where required.
Identify all Non-Potable water outlets with Warning signage, “Warning - Non-Potable Water”. Coordinate exact wording with engineer.

ADJUSTING

Relocate mechanical identification materials and devices that have become visually blocked by other work.

CLEANING

Clean faces of mechanical identification devices.

SECTION 15408 PLUMBING PIPE INSULATION

PART 1 - GENERAL

SUMMARY
This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

QUALITY ASSURANCE

Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

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.

Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

DELIVERY, STORAGE AND HANDLING

Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

COORDINATION

Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

Coordinate clearance requirements with piping Installer for insulation application.

SCHEDULING

Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Mineral-Fiber Insulation:

CertainTeed Manson.
Knauf FiberGlass GmbH.
Owens-Corning Fiberglas Corp.
Schuller International, Inc.
Or approved equal.

INSULATION MATERIALS

Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

FIELD-APPLIED JACKETS

General: ASTM C 921, Type 1, unless otherwise indicated.

Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
Adhesive: As recommended by insulation material manufacturer.
PVC Jacket Color: White.

Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC.
Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
Adhesive: As recommended by insulation material manufacturer.

ACCESSORIES AND ATTACHMENTS

Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
Aluminum: 0.007 inch thick.
Nickel-Copper Alloy: 0.005 inch thick.

Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

VAPOR RETARDERS

Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

EXECUTION

EXAMINATION

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION

Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

GENERAL APPLICATION REQUIREMENTS

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

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.

Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

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.
For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply adhesives and mastics at the manufacturer's recommended coverage rate.

Apply insulation with integral jackets as follows:
Pull jacket tight and smooth.
Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches on center.
Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
Seal penetrations with vapor-retarder mastic.
Apply insulation for exterior applications tightly joined to interior insulation ends.
Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
Seal metal jacket to roof flashing with vapor-retarder mastic.

Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

MINERAL-FIBER INSULATION APPLICATION

Apply insulation to straight pipes and tubes as follows:
Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.

For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches on center.
For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Apply insulation to flanges as follows:
Apply preformed pipe insulation to outer diameter of pipe flange.
Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

Apply insulation to fittings and elbows as follows:
Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
Cover fittings with standard PVC fitting covers.

Apply insulation to valves and specialties as follows:
Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
Apply insulation to flanges as specified for flange insulation application.
Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

FIELD-APPLIED JACKET APPLICATION

Foil and Paper Jackets: Apply foil and paper jackets where piping is concealed.
Draw jacket material smooth and tight.
Apply lap or joint strips with the same material as jacket.
Secure jacket to insulation with manufacturer's recommended adhesive.
Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

Apply PVC jacket on all exposed piping. Wrap Jacket with minimum 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

FINISHES

Color: Final color as selected by engineer. Vary first and second coats to allow visual inspection of the completed Work.

PIPING SYSTEM APPLICATIONS

Insulation materials and thicknesses are specified in schedules at the end of this Section.

Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
Flexible connectors.
Vibration-control devices.
Drainage piping located in crawl spaces, unless otherwise indicated.
Below-grade piping, unless otherwise indicated.
Chrome-plated pipes and fittings, unless potential for personnel injury.
Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

FIELD QUALITY CONTROL

Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
Inspect fittings and valves randomly selected by engineer.

Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

INSULATION APPLICATION SCHEDULE, GENERAL

Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

INTERIOR INSULATION APPLICATION SCHEDULE

Service: Domestic hot, and cold and Non-potable which are piped utilizing copper or steel or stainless-steel piping. Roof Drain Bodies exposed to interior of building and first 6ft of drain piping length down stream of Roof Drain body connections.
Operating Temperature: 50 to 140ºF.
Insulation Material: Mineral fiber.
Insulation Thickness: 1 (one) inch.
Vapor Retarder Required: No.
Jacket – Field applied:
PVC Jacket.

SECTION 15410 PLUMBING VALVES

PART 1 - GENERAL

SUMMARY

This Section includes the following general-duty valves:
Copper-alloy ball valves.
Iron, single flange butterfly valves
Bronze gate valves

DEFINITIONS

The following are standard abbreviations for valves:
CWP: Cold working pressure.
EPDM: Ethylene-propylene-diene terpolymer rubber.
NBR: Acrylonitrile-butadiene rubber.
PTFE: Polytetrafluoroethylene plastic.
TFE: Tetrafluoroethylene plastic.

SUBMITTALS

Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

QUALITY ASSURANCE

NSF Compliance: NSF 61 for valve materials for potable-water service.

DELIVERY, STORAGE, AND HANDLING

Prepare valves for shipping and storage as follows:
Protect internal parts against rust and corrosion.
Protect threads, flange faces, grooves, and weld ends.
Set angle, gate, and globe valves closed to prevent rattling.
Set ball valves open to minimize exposure of functional surfaces.
Block check valves in either closed or open position.

Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PRODUCTS

VALVES, GENERAL

Refer to Part 3 "Valve Applications" Article for applications of valves.

Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

Butterfly Valves: NPS 2-1/2 to 4 with Flanged ends, unless otherwise indicated.

Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

Valve Sizes: Same as upstream pipe, unless otherwise indicated.

Valve Actuators:
Hand wheel: For valves other than quarter-turn types.
Lever Handle: For quarter-turn valves NPS 6 and smaller.

Extended Valve Stems: On insulated valves.

COPPER-ALLOY BALL VALVES

Manufacturers:
Copper-Alloy Ball Valves:
Grinnell Corporation.
Milwaukee Valve Company
NIBCO INC.
Watts Industries, Inc.; Water Products Div.
Or approved equal.

Copper-Alloy Ball Valves, General: MSS SP-110.

Two--Piece, Copper-Alloy Ball Valves: Bronze body with full -port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem. Lead Free.

BRONZE GATE VALVES

Manufacturers:
Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:
Milwaukee Valve Company - Gate 1156
NIBCO INC.
Red-White Valve Corp.
Or approved equal.

Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

Type 2, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet. Lead Free

IRON BUTTERFLY VALVES

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
Full Lug Butterfly Valves: Hammond Valve, Milwaukee Valve Company, NIBCO, Watts.

Full Lug Iron Butterfly Valves: MSS SP-67, cast- or ductile-iron full lug body, rated for bi-directional dead end service at rated pressure without use of downstream flange, bubble-tight shutoff.
CWP Rating: 200-psig minimum.

Disc:	Aluminum bronze ASTM B148
Lining:	EPDM lining
Stem:	Stainless steel stem with upper and lower alignment bearings

EXECUTION

EXAMINATION

Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

Proceed with installation only after unsatisfactory conditions have been corrected.

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.

Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

Examine threads on valve and mating pipe for form and cleanliness.

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.

Do not attempt to repair defective valves; replace with new valves.

VALVE APPLICATIONS

Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

Shutoff Service: Ball or gate valves.

Throttling Service: Ball valves.

If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

Domestic Water Piping: Use the following types of valves:
Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.

For Stainless Steel piping systems utilize equivalent class stainless steel ball valves.
Gate Valves or Butterfly Valves, NPS 3 and Larger:

Select valves, except wafer and flangeless types, with the following end connections:
For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends.

VALVE INSTALLATION

Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

Locate valves for easy access and provide separate support where necessary.

Install valves in horizontal piping with stem at or above center of pipe.

Install valves in position to allow full stem movement.

JOINT CONSTRUCTION

Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

ADJUSTING

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.

SECTION 15420 PLUMBING WATER PIPING

PART 1 - GENERAL

SUMMARY

This Section includes water piping from locations indicated to fixtures and equipment inside the building.
This applies to the following piping systems which are 2.5” diameter or less shown on the plumbing drawings.
Potable Water – Hot, Cold and Tempered.
Non-Potable Water and Reclaim Water

Related Sections include the following:
Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
Water Service Piping: 160 psig.
Water Distribution Piping: 125 psig.

QUALITY ASSURANCE

Piping materials shall bear label, stamp, or other markings of specified testing agency.

Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PRODUCTS

PIPING MATERIALS

Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

COPPER TUBING

Hard Copper Tube: ASTM B 88, Type L , water tube, drawn temper.
Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
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.
Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

VALVES

Refer to Division 15 Section "Valves" for bronze, general-duty valves.

Refer to Division 15 Section "Plumbing Specialties" for balancing and drain valves.

EXECUTION

EXCAVATION

Refer to Sections outlining “Earthwork" for excavating, trenching, and backfilling.

PIPING APPLICATIONS

Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
NPS 4 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

VALVE APPLICATIONS

Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Drain Duty: Hose-end drain valves.

PIPING INSTALLATION

Refer to Division 15 Section "Basic Plumbing Materials and Methods" for basic piping installation.

Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

Install underground copper tubing according to CDA's "Copper Tube Handbook."

Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Plumbing Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Plumbing Mechanical Materials and Methods" for wall penetration systems.

Install aboveground domestic water piping level and plumb.

Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

Perform the following steps before operation:
Close drain valves, hydrants, and hose bibbs.
Open shutoff valves to fully open position.
Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

JOINT CONSTRUCTION

Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

VALVE INSTALLATION

Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping NPS 2 and smaller.

Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller.

Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

Install hose-end drain valves at low points in water mains, risers, and branches.

Install stop-and-waste drain valves where indicated.

HANGER AND SUPPORT INSTALLATION

Refer to Division 15 Section "Plumbing Hangers and Supports" for pipe hanger and support devices. Install the following:

Vertical Piping: MSS Type 8 or Type 42, clamps.

Individual, Straight, Horizontal Piping Runs: According to the following:

100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls.

Support pipe rolls on trapeze.

Install supports according to Division 15 Section "Hangers and Supports."

Support vertical piping and tubing at base and at each floor.

Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.

NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.

NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

NPS 2-1/2: 108 inches with 1/2-inch rod.

NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

Install supports for vertical copper tubing every 10 feet

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

CONNECTIONS

Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to equipment and machines to allow service and maintenance.

Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:

Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

FIELD QUALITY CONTROL

Inspect domestic water piping as follows:

Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
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:
    Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test domestic water piping as follows:
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.
Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
Prepare reports for tests and required corrective action.

CLEANING

Clean and disinfect potable domestic water piping as follows:
Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    Flush piping system with clean, potable water until dirty water does not appear at outlets.
    Fill and isolate system according to either of the following:
        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.
        Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

Prepare and submit reports of purging and disinfecting activities.

Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

SECTION 15421 SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

SUMMARY

This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

For this project, the Sanitary waste piping is considered Reclaim Water Drain Piping.

Related Sections include the following:
Division 15 Section "Plumbing Specialties" for soil, waste, and vent piping systems specialties.

DEFINITIONS

The following are industry abbreviations for plastic and rubber piping materials:
ABS: Acrylonitrile-butadiene-styrene plastic.
EPDM: Ethylene-propylene-diene terpolymer.
NBR: Acrylonitrile-butadiene rubber.
PE: Polyethylene plastic.
PVC: Polyvinyl chloride plastic.

PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
Soil, Waste, and Vent Piping: 10-foot head of water.

SUBMITTALS

Product Data: For pipe, tube, fittings, and couplings.

Shop Drawings: For solvent drainage system, include plans, elevations, sections, and details.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

QUALITY ASSURANCE

Piping materials shall bear label, stamp, or other markings of specified testing agency.

Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PRODUCTS

PIPING MATERIALS

Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

Flexible Transition Couplings for Underground Non-Pressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

PVC PIPING

PVC Pipe: Schedule 40 ASTM D 2665, solid-wall drain, waste, and vent.
PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

PE ENCASEMENT

PE Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

EXECUTION

EXCAVATION

Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

PIPING APPLICATIONS

Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

Aboveground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
NPS 1-1/4 to NPS 8: PVC pipe, PVC socket fittings, and solvent-cemented joints.

Underground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
NPS 1 ½ to NPS 8 : PVC pipe, PVC socket fittings, and solvent-cemented joints.

PIPING INSTALLATION

Refer to Division 15 Section "Basic Plumbing Materials and Methods" for basic piping installation.

Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Plumbing Materials and Methods" for wall penetration systems.

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."

Encase underground piping with PE film according to ASTM A 674 or AWWA C105.

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 2 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.

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.

Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

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.
Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:

Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

Install underground PVC soil and waste drainage piping according to ASTM D 2321.

Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

JOINT CONSTRUCTION

Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
Hubless Joints: Make with rubber gasket and sleeve or clamp.

PVC Non-Pressure Piping Joints: Join piping according to ASTM D 2665.

VALVE INSTALLATION

Refer to Division 15 Section "Valves" for general-duty valves.

Shutoff Valves: Install shutoff valve on each sewage pump discharge.
Use gate or full-port ball valve for piping NPS 2 and smaller.
Use gate valve for piping NPS 2-1/2 and larger.

Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

HANGER AND SUPPORT INSTALLATION

Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices.
Install the following:
Vertical Piping: MSS Type 8 or Type 42, clamps.
Individual, Straight, Horizontal Piping Runs: According to the following:
100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls.
Support pipe rolls on trapeze.
Base of Vertical Piping: MSS Type 52, spring hangers.

Install supports according to Division 15 Section "Hangers and Supports."

Support vertical piping and tubing at base and at each floor.

Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
NPS 3: 48 inches with 1/2-inch rod.
NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

Install supports for vertical PVC piping every 48 inches.

Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
NPS 3: 60 inches with 1/2-inch rod.
NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
NPS 6: 60 inches with 3/4-inch rod.
NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

Install supports for vertical cast-iron soil piping every 15 feet.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

CONNECTIONS

Drawings indicate general arrangement of piping, fittings, and specialties.

Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

Connect drainage and vent piping to the following:

Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."

Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."

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.

FIELD QUALITY CONTROL

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.

Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

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.

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.

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.

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.

Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

Prepare reports for tests and required corrective action.

CLEANING

Clean interior of piping. Remove dirt and debris as work progresses.

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

Place plugs in ends of uncompleted piping at end of day and when work stops.

PROTECTION

Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint. Color to match architectural features adjacent to exposed piping.

SECTION 15430 PLUMBING SPECIALTIES

PART 1 - GENERAL

SUMMARY

This Section includes the following plumbing specialties:
Backflow preventers.
Strainers.
Wheel-handle wall hydrants.
Drain valves.
Miscellaneous piping specialties.
Sleeve penetration systems.
Flashing materials.
Cleanouts.
Floor drains and Trench Drains.

DEFINITIONS

The following are industry abbreviations for plastic piping materials:
ABS: Acrylonitrile-butadiene-styrene plastic.
PE: Polyethylene plastic.
PUR: Polyurethane plastic.
PVC: Polyvinyl chloride plastic.

PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
Domestic Water Piping: 125 psig.
Sanitary Waste and Vent Piping: 10-foot head of water.

SUBMITTALS

Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

Backflow preventers.
Drain valves, hose bibbs, hydrants, and hose stations.
Floor drains.

Field test reports.

Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
Backflow preventers.
Hose stations and hydrants.

STATE OF WISCONSIN RECUCED PRESSURE ZONE ASSEMBLY REGISTRATION

Work of this section included submitting for State of Wisconsin Plumbing registration of the Reduced Pressure Backflow Preventer. Application for registration and fee required for registration with the State is part of the work scope associated with the installation of this device.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

NSF Compliance:
Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PRODUCTS

BACKFLOW PREVENTERS

Manufacturers:
Watts Industries, Inc.

General: ASSE standard, backflow preventers.
NPS 2 and Smaller: Bronze body with threaded ends.
Interior Components: Corrosion-resistant materials.
Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
Strainer: On inlet, if indicated.

Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with non-removable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves; intermediate atmospheric vent; and non-removable, ASME B1.20.7, garden-hose threads on outlet.

Reduced Pressure Zone Assemblies: Size and model as called out on drawings.
Lead Free
Stainless steel internal parts.
Fused epoxy coated and lined checks
File reversible relielf valve
Provide with strainer and shutoff valves.
Epoxy coated

STRAINERS

Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.
Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
NPS 2 and Smaller: Bronze body, with female threaded ends.
Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
Drain: Pipe plug.

WHEEL-HANDLE WALL HYDRANTS

Manufacturers:
NIBCO INC.
Sioux Chief Manufacturing Co., Inc.
Watts Industries, Inc.; Water Products Div.
Woodford Manufacturing Co.
Zurn Industries, Inc.; Jonespec Div.
Or approved equal.

Description: Frost-proof design similar to ASME A112.21.3M, for wall mounting with wheel-handle operation, NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, casing and operating rod to match wall thickness, and projecting outlet with ASME B1.20.7 garden-hose threads on outlet. Include wall clamp; integral vacuum breaker or non-removable, drainable hose-connection vacuum breaker complying with ASSE 1011 ; and garden-hose threads complying with ASME B1.20.7 on outlet.

DRAIN VALVES

Hose-End Drain Valve: MSS SP-80, gate valve, Class 125, ASTM B 62 bronze body, with NPS 3/4 threaded or solder-joint inlet and ASME B1.20.7, garden-hose threads on outlet and cap. Hose bibs are prohibited for this application.

MISCELLANEOUS PIPING SPECIALTIES

Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.
Manufacturers:
Josam Co.
Smith, Jay R. Mfg. Co.

Tyler Pipe; Wade Div.
Zurn Industries, Inc.; Specification Drainage Operation
Or approved equal.

Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 8-inches from pipe with galvanized steel boot reinforcement, and counter flashing fitting.

Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.
NPS 2-1/2 and Larger: 5-inch- minimum water seal.

Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semi-open top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

Stack Flashing Fittings: Counter flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counter flashing.

SLEEVE PENETRATION SYSTEMS

Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
Stack Fitting: ASTM A 48, gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

FLASHING MATERIALS

Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
General Use: 4-lb/sq. ft., 0.0625-inch thickness.
Vent Pipe Flashing: 3-lb/sq. ft., 0.0469-inch thickness.
Burning: 6-lb/sq. ft., 0.0938-inch thickness.

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.

Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

Fasteners: Metal compatible with material and substrate being fastened.

Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

Solder: ASTM B 32, lead-free alloy.

Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

CLEANOUTS

Cleanouts: Comply with ASME A112.36.2M .
Application: Floor cleanout, Wall cleanout, For installation in exposed piping.
Manufacturers:
- Josam Co.
- Sioux Chief Manufacturing Co., Inc.
- Smith, Jay R. Mfg. Co.
- Tyler Pipe, Wade Div.
- Watts Industries, Inc.
- Zurn Industries, Inc.
- Or approved equal.

Body or Ferrule Material: Cast iron.
Outlet Connection: Threaded.
Closure: Brass plug with straight threads and gasket.
Adjustable Housing Material: Cast iron with set-screws or other device.
Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
Frame and Cover Shape: Round.
Top Loading Classification: Light Duty.

FLOOR AND TRENCH DRAINS

Floor and Trench Drains: Provide floor drains as specified in plumbing fixture schedule.

EXECUTION

INSTALLATION

Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

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.
Locate backflow preventers in same room as connected equipment or system.
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 not acceptable for this application.
Do not install bypass piping around backflow preventers.

Install draining-type ground post hydrants with 1 cu. yd. of crushed gravel around drain hole.

Set ground hydrants with box flush with grade.

Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

Locate at each change in direction of piping greater than 45 degrees.

Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

Locate at base of each vertical soil and waste stack.

Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

Position floor drains for easy access and maintenance.

Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.

Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Fasten recessed-type plumbing specialties to reinforcement built into walls.

Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

CONNECTIONS

Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to equipment to allow service and maintenance.

Connect plumbing specialties to piping specified in other Division 15 Sections.

Ground equipment.

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.

Connect plumbing specialties and devices that require power according to Division 16 Sections.

FLASHING INSTALLATION

Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft., 0.0625-inch thickness or thinner.
Copper Sheets: Solder joints of copper sheets.

Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

Set flashing on floors and roofs in solid coating of bituminous cement.

Secure flashing into sleeve and specialty clamping ring or device.

Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

Fabricate and install flashing and pans, sumps, and other drainage shapes.

LABELING AND IDENTIFYING

Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer, thermostatic water mixing valve, water tempering valve.
Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

PROTECTION

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

Place plugs in ends of uncompleted piping at end of each day or when work stops.

SECTION 15441 EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

SUMMARY

This Section includes the following emergency plumbing fixtures:
Eyewash Unit.
Water-tempering equipment.

DEFINITIONS

Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

PVC: Polyvinyl chloride plastic.

Tepid: Approximately 80 deg Ftemperature.
Allowable Variation: Plus or minus 5 deg F.

SUBMITTALS

Product Data: Include flow rates and capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each product indicated.

Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals specified in Division 1.

QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities about plumbing fixtures for people with disabilities.

Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

COORDINATION

Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PRODUCTS

MANUFACTURERS

For fixture descriptions in other Part 2 articles where the subparagraph titles "Products" introduce a list of manufacturers and their products, the following requirements apply for product selection:
Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.

EYEWASH UNITS

Wall mounted eyewash unit.
ANSI Z358.1-2014 for eyewash.

Spray head Assembly
spray heads
Flip top dust covers
Internal flow control

Valve
Stainless steel push handle

Mounting
Wall mounted

Supply
1/2” NPT male swivel-type inlet

Sign
ANSI compliant identification sign

Manufacturers
Bradley
Guardian
Or approved equal

WATER-TEMPERING EQUIPMENT

Hot- and Cold-Water-Tempering Equipment: Factory-fabricated equipment including water thermostatic mixing valve designed to provide 70 deg Fpotable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg Fthroughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, corrosion-resistant metal piping, and enclosure.
Manufacturers:
Guardian Equipment – TMV G3600LF Thermostatic Mixing Valve.
Bradley
Haws Corporation
Lawler Manufacturing Co., Inc.
Leonard Valve Co.
Or approved equal.

SOURCE QUALITY CONTROL

Certify performance of plumbed emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

EXECUTION

EXAMINATION

Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

EMERGENCY PLUMBING FIXTURE INSTALLATION

Install per manufacturer’s recommendation and requirements.

Assemble emergency plumbing fixture piping, fittings, control valves, and other components according to manufacturers written instructions.

Install fixtures level and plumb.

Fasten fixtures to substrate.

Install shutoff valves in water supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Refer to Division 15 Section "Plumbing Valves" for general-duty shutoff valves.
Exception: Omit shutoff valves on valved supplies to group of plumbing fixtures that includes emergency plumbing fixture.
Exception: Omit shutoff valves on supplies to emergency equipment if prohibited by authorities having jurisdiction.

Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Refer to Division 15 Section "Basic Plumbing Materials and Methods" for dielectric fittings.

FIELD QUALITY CONTROL

Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.

Electrical-Component Testing: After electrical circuitry has been energized, test for compliance with requirements.
Test and adjust controls and safeties.

Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

Report test results in writing.

ADJUSTING

Adjust or replace fixture flow regulators for proper flow.

Adjust equipment temperature settings.

SECTION 15485 DOMESTIC WATER HEATERS

PART 1 - GENERAL

SUMMARY

This Section includes the following for domestic water systems:
Commercial, electric water heaters.
Accessories.

SUBMITTALS

Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.

Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.

Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

ASME Compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

ASHRAE Standards: Comply with performance efficiencies prescribed for the following:
ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.

WARRANTY

General Warranty: Special warranty specified in this Article shall not deprive owner of other rights owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by contractor under requirements of the Contract Documents.

Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of water heaters that fail in materials or workmanship within specified warranty period.
Failures include heating elements and storage tanks.
Warranty Period: From date of Substantial Completion:
Heating Elements: Five years.
Storage Tanks: 10 years.

PRODUCTS

COMMERCIAL, STORAGE, ELECTRIC WATER HEATERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
Commercial, Storage, Electric Water Heaters:
Smith: A. O. Smith Water Products Co.
Rheem Manufacturing Co.; Ruud Water Heater Div.
Or approved equal.
Water Heater Stand and Drain Pan Units:
Safety: W. H. Safety Products, Inc.
Oatey
Or approved equal.

Description: Comply with UL 1453.

Storage Tank Construction: Steel with 150-psig working-pressure rating.
Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rods, and controls as required. Attach tappings to tank shell before testing and labeling.
NPS 2 and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.
NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
Jacket: Steel, with enameled finish.

Heating Elements: Electric, screw-in or bolt-on, immersion type arranged in multiples of three.
Exception: Water heaters up to 9-kW input may have 2 or 3 elements.
Staging: Input not exceeding 18 kW per step.
Temperature Control: Adjustable, immersion thermostat.
Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.

Anode Rods: Factory installed, magnesium.

Dip Tube: Factory installed. Not required if cold-water inlet is near bottom of storage tank.

Special Requirement: NSF 5 construction.

WATER HEATER ACCESSORIES

Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.

Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch-high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1, pipe thread.

Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated, steel bracket for wall mounting and capable of supporting water heater and water.

Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE 90.1 or ASHRAE 90.2.

Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

Option: Separate temperature and pressure relief valves are acceptable instead of combination relief valve.

Exception: Omit combination temperature and pressure relief valve for tankless water heater, and furnish pressure relief valve for installation in piping.

Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than heat-exchanger working-pressure rating.

Vacuum Relief Valves: Comply with ASME PTC 25.3. Furnish for installation in piping.

Exception: Omit if water heater has integral vacuum-relieving device.

Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

EXECUTION

WATER HEATER INSTALLATION

Install and connect water heaters per manufacturer’s requirements.

Install commercial water heaters on concrete bases for floor mounted applications.

Exception: Omit concrete bases for water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.

Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

Anchor water heaters to substrate.

Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

Install pressure relief valves in water piping for water heaters without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

Install vacuum relief valves in cold-water-inlet piping.

Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section "Plumbing Specialties" for drain valves.

Install thermometers on water heater inlet and outlet piping. Adjust faces to proper angle for best visibility.

For sealed combustion Gas Fired Water Heaters, install venting and combustion air intake piping per the Manufacturer’s requirements.

Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 15 Section "Plumbing Valves" for general-duty valves.

Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

Fill water heaters with water.

CONNECTIONS

Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to machine to allow service and maintenance.

Connect hot- and cold-water piping with shutoff valves and unions.

For Gas fired water heaters, connect gas service piping.

Make connections with dielectric fittings where piping is made of dissimilar metal.

Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.

Ground equipment.

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.

FIELD QUALITY CONTROL

Engage a factory-authorized service representative to perform startup service.

In addition to manufacturer's written installation and startup checks, perform the following:
Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
Verify that piping system tests are complete.
Check for piping connection leaks.
Check for clear relief valve inlets, outlets, and drain piping.
Test operation of safety controls, relief valves, and devices.
Energize electric circuits.
Adjust operating controls.
Adjust hot-water-outlet temperature settings. Do not set above 140 deg F unless piping system application requires higher temperature.

21. Brining Building Heating and Ventilation, Item SPV.0105.05.

A Description

This special provision describes providing heating and ventilation construction required to complete the Brining Building according to the applicable plans, the 'General Requirements for Building Construction', and the technical specficiations.

B (Vacant)

C (Vacant)

D Measurement

The department will measure Brining Building Heating and Ventilation by the lump sum completed according to the contract and accepted, as a single complete unit of work.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.05	Brining Building Heating and Ventilation	LS

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

INDEX OF HEATING AND VENTILATION SPECIFICATIONS

15500 Basic HVAC Requirements
15515 Basic HVAC System Material and Methods
15525 Supports, Anchors, Sleeves, and Sealing for HVAC Systems
15526 Identification for HVAC Systems
15588 Natural Gas Systems
15657 Breeching, Chimneys and Stacks
15863 Fuel Fired Unit Heaters
15887 HVAC Fans

SECTION 15500 BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

SUMMARY

Section Includes
This section includes general administrative and procedural requirements for HVAC installations.

REGULATORY REQUIREMENTS

Conform to all state and local code requirements.

Obtain permits and request inspections from authority having jurisdiction and pay for all fees incidental thereto.

PROJECT/SITE CONDITIONS

Install work in locations shown on drawings, unless prevented by project conditions.

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.

Project design is based around the first listed manufacturer in relative specification sections. Subsequent manufacturers listed are also acceptable. However, the use of these manufacturers may result in minor design changes involving equipment layout, supports, etc. Substituted manufacturers other than those listed will not be allowed. The contractor shall be responsible for such and include any modifications required as part of his bid.

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 engineer's review.

Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of engineer before proceeding.

QUALITY ASSURANCE

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.

DELIVERY, STORAGE, AND HANDLING

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.

ACCESSIBILITY

Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

Extend all grease fittings to an accessible location.

ROUGH-IN

Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

HVAC INSTALLATIONS

Coordinate HVAC equipment and materials installation with other building components.

Verify all dimensions by field measurements.

Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.

Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.

CUTTING AND PATCHING

This article specifies the cutting and patching of mechanical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.

The contractor shall perform cutting and patching as outlined in this article.

Do not endanger or damage installed work through procedures and processes of cutting and patching.
Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.
Where changes or removal of existing equipment, devices, etc. takes place. Contractor shall be responsible for restoring surfaces where original equipment devices, etc. were originally located to match existing surrounding surfaces.
No additional compensation will be authorized for cutting and patching work that is necessitated by ill timed, defective, or non-conforming installations.

Perform cutting, fitting, and patching of mechanical equipment and materials required to:
Uncover work to provide for installation of ill timed work;
Remove and replace defective work;
Remove and replace work not conforming to requirements of the Contract Documents.

Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

ELECTRICAL CONNECTIONS

Line voltage wiring (115 volts and over) required for the connection of the heating and ventilating equipment to be done under Division 16; line voltage temperature control wiring required for the operation of the HVAC system shall be under Division 15, unless shown on the electrical drawings (Division 16). Low voltage wiring (below 115 volts) to be done by the HVAC contractor but shall conform to Division 16 requirements.

The HVAC contractor to furnish necessary controls, wiring diagrams, and instruction sheets, and coordinate his work with that of the Electrical contractor to assure proper connection and operation of controls and equipment.

The HVAC contractor to be responsible for the operation of the system, temperature, safety, and other controls on the work during installation and guarantee period including equipment furnished by owner.

Magnetic starters, pushbutton stations, pilot lights, etc. not an integral part of packaged mechanical equipment, to be furnished under Division 16, unless otherwise noted in the equipment specification section or equipment schedule.

Magnetic starters, pushbutton stations, pilot lights, etc, shall conform to Division 16 requirements. Manufacturers of starters and disconnects shall be of same manufacturer as items furnished as part of Division 16.

Disconnect switches, fused disconnects, capped safety switches, etc. as noted shall be furnished by the HVAC contractor whether specifically noted or not.

Electrical work and connections to be per Division 16 requirements.

PRODUCTS (NOT USED)

EXECUTION (NOT USED)

SECTION 15515 BASIC HVAC SYSTEM MATERIALS & METHODS

PART 1 - GENERAL

SUMMARY

This Section includes the following:
Piping materials and installation instructions common to most piping systems.
Sleeves.
Escutcheons.
Pipe Penetrations
Equipment installation requirements common to equipment sections.
Painting and finishing.
Supports and anchorages.

DEFINITIONS

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.

Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

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.

The following are industry abbreviations for plastic materials:
ABS: Acrylonitrile-butadiene-styrene plastic.
CPVC: Chlorinated polyvinyl chloride plastic.
PE: Polyethylene plastic.
PVC: Polyvinyl chloride plastic.

The following are industry abbreviations for rubber materials:
EPDM: Ethylene-propylene-diene terpolymer rubber.
NBR: Acrylonitrile-butadiene rubber.

QUALITY ASSURANCE

Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

DELIVERY, STORAGE, AND HANDLING

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.

Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

COORDINATION

Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

PRODUCTS

MANUFACTURERS

In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

PIPE, TUBE, AND FITTINGS – GENERAL

Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

JOINING MATERIALS – GENERAL

Refer to individual Division 15 piping Sections for special joining materials not listed below.

Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

PIPE PENETRATIONS – GENERAL

Provide steel pipe sleeves with minimum wall thickness of 1/4 inch for pipes passing through beams and walls of concrete, brick, tile, or masonry, and 22 gage galvanized iron sleeves for pipes passing through other parts of construction. Provide steel pipe for all sleeves penetrating floors. Furnish each sleeve having inside diameter 1 inch larger than outside diameter of un-insulated and insulated pipe, unless wall or floor is a firewall, in which case, only the pipe shall penetrate.

For pipes passing through floors, walls, and ceilings provide chrome-plated brass escutcheons having outside diameter to cover sleeved openings and inside diameter to fit pipe.

Non- rated surfaces

Stamped steel, chrome plated, hinged, split ring escutcheons or floor-ceiling plates for covering openings in occupied spaces.

In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water stop type wall sleeve.

At interior partitions where pipe penetrations are sealed, use Tremco Dymonic, Sika Corp. Sikaflex 1a, Sonneborn Sonolastic NPI, or Mameco Vulken 116 urethane caulk to affect the seal. Use galvanized sheet metal sleeves in hollow wall penetrations.

EXECUTION

PIPING SYSTEMS – COMMON REQUIREMENTS

Install piping according to the following requirements.

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.

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.

Install piping to permit valve servicing.

Install piping free of sags and bends.

Install fittings for changes in direction and branch connections.

Select system components with pressure rating equal to or greater than system operating pressure.

Sleeves are required for core-drilled holes; see detail at end of this section.

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

Cut sleeves to length for mounting flush with both surfaces.

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.

Install sleeves in new walls and slabs as new walls and slabs are constructed.
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:
Steel Pipe Sleeves: For pipes smaller than NPS 6.
Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
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.

Verify final equipment locations for roughing-in.

Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

PIPING JOINT CONSTRUCTION

Join pipe and fittings according to the following requirements.

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

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:
Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
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.

Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

PIPING CONNECTIONS – GENERAL

Make connections according to the following, unless otherwise indicated:
Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

Install equipment to allow right-of-way for piping installed at required slope.

PAINTING

Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

ERECTION OF METAL SUPPORTS AND ANCHORAGES

Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

Field Welding: Comply with AWS D1.1.

SECTION 15525 SUPPORTS, ANCHORS, SLEEVES, AND SEALING FOR HVAC SYSTEMS

PART 1 - GENERAL

SUMMARY

This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors, sleeves, and sealing.

REFERENCES

MSS SP-58 Pipe Hangers and Supports - Materials, Design, and Manufacture

MSS SP-59 Pipe Hangers and Supports - Selection and Application

PRODUCTS

GENERAL - SUPPORTS

Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support mechanical equipment.

Provide support, anchors, and sleeves compatible with atmosphere where located. For applications associated with this project which are located in Salt Storage buildings and Salt Brining Rooms, these areas are to be considered corrosive atmospheres. Use Stainless Steel version of hanger model and type listed in this Section. Also utilize Stainless or non-metallic version of Uni-strut material.

PIPE HANGERS AND SUPPORTS

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.

Manufacturers: B Line, Fee and Mason, Grinnell, Kindorf, Michigan Hanger, Unistrut, or approved equal. Grinnell figure numbers are listed below; equivalent material by other manufacturers is acceptable.

Note: All steel pipe supports shall have galvanized finish (Pregalvanized or hot dipped) or as called for in paragraph 2.1, B above.

TRAPEZE PIPE HANGERS

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.

METAL FRAMING SYSTEMS

Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

Manufacturers:
B-Line Systems, Inc.; a division of Cooper Industries.
Unistrut Corp.; Tyco International, Ltd.

Coatings: None – material shall be Stainless Steel or non-metallic.

THERMAL-HANGER SHIELD INSERTS

Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

Manufacturers:
Carpenter & Paterson, Inc.
ERICO/Michigan Hanger Co.
PHS Industries, Inc.
Pipe Shields, Inc.
Rilco Manufacturing Company, Inc.
Value Engineered Products, Inc.
Or approved equal.

Insulation-Insert Material for Hot Piping. Provide one of the following:
Water-repellent treated, ASTM C 533, Type I calcium silicate
Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass
ASTM C 552, Type II cellular glass.

For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

FASTENER SYSTEMS

Mechanical-Expansion Anchors: Insert-wedge-type 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.
Manufacturers:
B-Line Systems, Inc.; a division of Cooper Industries

Empire Industries, Inc.
Hilti, Inc.
ITW Ramset/Red Head
MKT Fastening, LLC.
Powers Fasteners
Or approved equal.

Floor Support for Pipe Sizes to 4 Inches
Insulated and Non- Insulated Pipe: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and Galvanized steel support.

STEEL HANGER RODS

Threaded both ends, threaded one end, or continuous threaded, stainless steel finish,

Size rods for individual hangers and trapeze support as indicated in the following schedule. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (lbs.)

Maximum Load (lbs.) (650 deg F Maximum Temperature)	Road Diameter (inches)
610	3/8
1130	½
1810	5/8
2710	¾
3770	7/8
4960	1
8000	1-1/4

Provide rods complete with adjusting and lock nuts.

FLASHING

Metal Flashing: per Section 07600 - Flashing and Sheet Metal.

Lead Flashing: 5 pounds per square foot sheet lead for waterproofing; 1 pound per square foot sheet lead for soundproofing.

Flexible Flashing: 47 mil thick sheet compatible with roofing.

Caps: Steel, 22-gage minimum; 16 gage at fire resistant elements.

SLEEVES

Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

Steel Sheet Metal: 24 gauge (0.70 mm) or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
Cast Iron: Cast or fabricated wall pipe equivalent to ductile iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with one mechanical joint end conforming to AWWA C111 and one plain pipe sleeve end.
Penetrating Pipe Deflection: 5 percent without leakage.
Housing: Ductile iron casting having waterstop and anchor ring, with ductile iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
Pipe Sleeve: AWWA C151, ductile iron pipe.
Housing to Sleeve Gasket: Rubber or neoprene push on type of manufacturer's design.
Cast Iron Sleeve Fittings: Commercially made sleeve having an integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
Underdeck Clamp: Clamping ring with set screws.
PVC Plastic: Manufactured, permanent, with nailing flange for attaching to wooden forms.
PVC Plastic Pipe: ASTM D1785, Schedule 40.
PE Plastic: Manufactured, reusable, tapered, cup shaped, smooth outer surface, with nailing flange for attaching to wooden forms.

SEALING AND FIRESTOPPING

Non-Rated Penetrations
Pipe Penetrations Through Below Grade Walls: In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water stop type wall sleeve.
Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade use urethane caulk in annular space between pipe insulation and sleeve.
Duct Penetrations:
Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2 inches. Where existing openings have an annular space larger than 2 inches, the space shall be patched to match existing construction to within 2 inches around the duct.
Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4-inch sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

MISCELLANEOUS MATERIALS

Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; galvanized.

EXECUTION

GENERAL

Provide all supporting devices as required for the installation of mechanical equipment and materials.

Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

Protect insulation at all hanger points.

Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

HANGER AND SUPPORT APPLICATIONS

Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

Use hangers and supports which are Stainless Steel or non-metallic versions suitable for corrosive atmosphere.

Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
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.
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.
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.
Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.
U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

HANGER AND SUPPORT INSTALLATION

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.

Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

Each fiberglass strut system in first paragraph below requires calculation and detail.

Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

Fastener System Installation:
Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

Each equipment support in first paragraph below requires calculation and detail.

Equipment Support Installation: Fabricate from welded-structural-steel shapes.

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.

Install lateral bracing with pipe hangers and supports to prevent swaying.

Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2and 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.

Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

GENERAL SUPPORT INSTALLATION

Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

Coordinate hanger and support installation to properly group piping of all trades.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

Perform all welding according to standards of the American Welding Society. Clean surfaces of loose scale, rust, paint, or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

HANGER AND SUPPORT SPACING

Place a hanger within 12 inches of each horizontal elbow valve, strainer, or similar piping specialty item.

Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain the slope specified in the piping section of this specification.

Space hangers for pipe as follows:

Pipe Material	Pipe Size	Maximum Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"
Steel	8" through 12"	14'-0"
Steel	14" and over	20'-0"

VERTICAL RISER CLAMPS

Support vertical piping with clamps secured to the piping and testing on the building structure at each floor.

Piping 5 inches and above, of lengths exceeding 30 feet, shall be additionally supported on base elbows secured to the building structure, with flexible supporting hangers provided at top of riser to allow for pipe expansion.

EQUIPMENT SUPPORTS

Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

Grouting: Place grout under supports for equipment and make smooth bearing surface.

Provide lateral bracing, to prevent swaying, for equipment supports.

METAL FABRICATIONS

Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

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:
Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
Obtain fusion without undercut or overlap.
Remove welding flux immediately.
Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

ADJUSTING

Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

PAINTING

Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

FLASHING

Provide a flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed according to manufacturer's instructions for sound control.

SLEEVES

Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated. Grout space between sleeve and structure.

Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, concrete floor and roof slabs, and where indicated.

Cut sleeves to length for mounting flush with both surfaces.

Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring where specified.

Build sleeves into new walls and slabs as work progresses.

Install large enough sleeves to provide 1/4-inch (6 mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

PVC Pipe Sleeves: For pipes smaller than 6 inches (150 mm).

Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).

Steel Sheet Metal Sleeves: For pipes 6 inches (150 mm) and larger that penetrate gypsum board partitions.

Cast Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Flashing is specified in Division 7 Section "Flashing and Sheet Metal".

Seal space outside of sleeve fittings with non-shrink, non-metallic grout.

Except for below grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.

Above Grade, Exterior Wall, and Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25 mm) annular clear space between pipe and sleeve for installation of mechanical seals.

Install steel pipe for sleeves smaller than 6 inches (150 mm).

Install cast iron wall pipes for sleeves 6 inches (150 mm) and larger.

Assemble and install mechanical seals according to manufacturer's printed instructions.

Below Grade, Exterior Wall, Pipe Penetrations: Install cast iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25 mm) annular clear space between pipe and sleeve for installation of mechanical seals.

Below Grade, Exterior Wall, Pipe Penetrations: Install ductile iron wall penetration system sleeves according to manufacturer's printed installation instructions.

SEALING

Non-Rated Partitions:

In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, according to manufacturer's instructions.

At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetrations in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

SECTION 15526 IDENTIFICATION FOR HVAC SYSTEMS

PART 1 - GENERAL

SUMMARY

Identification of all HVAC products installed under Division 15.

Painting of HVAC piping and supports.

REFERENCES

American National Standards Institute (ANSI):
ANSI/ASME: Scheme for the Identification of Piping Systems.

PRODUCTS

MATERIALS – IDENTIFICATION SYSTEMS

Color: Unless specified otherwise, conform with ANSI/ASME A13.1.

Snap On Plastic Pipe Markers: Manufacturer's standard preprinted, semi rigid snap on, color coded pipe markers, conforming to ASME A13.1

Plastic Equipment Markers: Laminated plastic, color coded equipment markers: Conform to following color code:

Green: Cooling equipment and components.
Yellow: Heating equipment and components.
Yellow/Green: Combination cooling and heating equipment and components.
Blue: Equipment and components that do not meet any of the above criteria.
For hazardous equipment, use colors and designs recommended by ASME A13.1.
Nomenclature: Include following, matching terminology on schedules as closely as possible:

Name and plan number.
Equipment service.

Size: Approximately 2½ by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4½ by 6 inches (115 by 150 mm) for equipment.

Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, letter, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

MATERIALS - PAINT SYSTEMS

Acceptable Manufacturers
Tnemec
Carbolene
Or approved equal.

Painting Systems
Application on metal piping and pipe and equipment supports:

Non-submerged, normal conditions, indoors.
Generic Type: Polyamidoamine epoxy.
Finish Coat: Tnemec Series 69.

Interior: Two coats Series 69.
Exterior: One coat Series 69, one coat Series 74.
Primer Coat: Self priming.
Minimum Dry Mil Thickness: 5 to 8 mil.
Surface Preparation: Hand tool clean.

EXECUTION

GENERAL

Where more than one type of mechanical identification is specified for listed application, selection is installer's option, but provide single selection for each product category.

Degrease and clean surfaces to receive adhesive for identification materials.

LABELING AND IDENTIFYING

Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

Plastic markers: Install on pipe insulation segment where required for hot non-insulated pipes.

Locate pipe markers wherever piping is exposed in finished spaces, equipment rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exposed exterior locations as follows:

Near each valve and control device.

Near each branch, excluding short take offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.

Near locations where pipes pass through walls, floors, ceilings, or enter inaccessible enclosures.

At access doors, manholes, and similar access points that permit view of concealed piping.

Near major equipment items and other points of origination and termination.

Spaced at a maximum of 50-foot (15 m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.

On piping above removable acoustical ceilings, except omit intermediately spaced markers.

Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

Lettering Size: Minimum ¼ inch (6 mm) high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), ½ inch (13 mm) high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 1/2 to ¾ of size of principal lettering.

Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

Adjusting: Relocate identifying devices, which become visually blocked by work of this Division or other Divisions.

PAINTING

Color Coding and Labeling of Piping and Equipment - The following color code shall be applied for all new piping installed as part of this project exposed to view:
Natural gas piping (interior) – yellow; (exterior) - grey

Protection of Finished Work and Equipment
Protect with tarpaulin or drop cloth all floors, walls, glass, finished painted work, and equipment from paint spatter or other damage that might result from this Work.
Promptly remove all oil, paint, and solvent waste rags from the site and legally dispose of them. Do not burn waste materials.
Paint, varnish, and mixing cans shall not be placed on bare floors.
Dirty, oily, and dusty cover shall not be used.
No stains or spots shall remain after completion of painting. Remove hardware accessories, light fixtures, and similar items before painting.
Replace above items after finish coat is applied.
Masking may be utilized in lieu of removal of items.

Application
Application may be by brushing or rolling. Method used shall be one as approved by material manufacturer for any one particular product.
Brushing: Brush in one direction then smooth at right angles to original brushing to produce a uniform thickness of coating.
Thickness of Coating: Where number of coats is indicated, it is intended to show the normal practice to obtain the proper dry mil thickness.
The dry mil film thickness must be provided in all cases even though it may require additional coatings to that specified. Contractor must provide adequate ventilation at all times.

Ventilation shall be adequate to remove fumes, preventing injury to workmen, or possibility of accumulating volatile gases.

Contractor to provide one can (quart size) of touch up paint for each color used to owner.

SECTION 15588 NATURAL GAS SYSTEMS

PART 1 - GENERAL

SUMMARY

Extent of work is limited to piping and accessories as required to extend natural gas line from meter to gas fired equipment as indicated on drawings and schedules as required by this section.

Contractor to verify Gas Pressure available with local natural gas utility and to provide piping system including gas pressure step down regulators as may be needed.

REFERENCES

National Fire Protection Association (NFPA):
Standard 54 (ANSI Z223.1) National Fuel Gas Code (An American National Standard)

PRODUCTS

MATERIALS AND PRODUCTS

General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where applicable, base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in natural gas systems. Where more than one type of material or product is indicated, selection is Installer's option.

BASIC PIPES AND PIPE FITTINGS

Building Distribution Piping
Pipe Size 2 inches and Smaller: Black steel pipe; Schedule 40, malleable iron threaded fittings.
Pipe Size 2½ inches and Larger: Black steel pipe: Schedule 40; wrought steel butt-welding fittings.

SPECIAL VALVES

General: Special valves required for natural gas systems include the following types:
Gas Cocks:
Gas Cocks 2 inches and Smaller: 150 psi non- shock WOG, bronze straightway cock, flat or square head, threaded ends.
Gas Cocks 2½ inches and Larger: 125 psi non- shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.
Pressure Regulators: Step down pressure regulator, lock-up type staging type, reduction and capacity as required.

Manufacturer: Subject to compliance with requirements, provide gas cocks of one of the following:
NIBCO, Inc.
DeZurik Corporation
Jenkins Bros.
Lunkenheimer Company
Rockwell International, Flow Control Division
Stockham Valves and Fittings
Walworth Company
Or approved equal.

EXECUTION

INSTALLATION OF NATURAL GAS PIPING

Use sealants on metal gas piping threads that are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

Remove cutting and threading burrs before assembling piping.

Do not install defective piping or fittings. Do not use pipe with threads that are chipped, stripped or damage

Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

Install drip legs in gas piping where indicated, and where required by code or regulation.

Install "tee" fittings with bottom outlet plugged or capped, at bottom of pipe risers.

Install piping with 1/64 inch per foot downward slope in direction of flow.

Install piping parallel to other piping, but maintain minimum of 12-inch clearance between gas piping and steam or hydronic piping above 200 deg F.

Install gas pressure regulator at equipment. Size for pressure leaving meter, required pressure at equipment and required flow. Vent per code to atmosphere. NOTE: Coordinate gas pressures provided and placement of step down regulators where they may be required.

All pipe supports to be spaced a maximum of 5 feet.

GAS SERVICE

General: Coordinate with local gas Utility Company the installation of a new gas service to serve the new facility.
Coordinate with the Utility the available gas pressure and gas load required.
Coordinate any required meter installation and location with the Utility.
Consult with Utility as to extent of its work, costs, and fees associated with any service size increases or modifications. Pay such costs and fees.
Verify pressure leaving the meter. Gas piping distribution system was sized based on the indicated pressure leaving the meter as shown on the plans. If needed modify the gas pipe size based on actual pressures being provided.

Provide step down gas regulators as required at each structure and as may be needed at each natural gas burning device/equipment.

INSTALLATION OF PIPING SPECIALTIES

Do not conceal any gas piping or specialties.

INSTALLATION OF VALVES

Gas Cocks: Provide at connection to gas train for each gas fired equipment item and on risers and branches where indicated.

Locate gas cocks where easily accessible, and where they will be protected from possible injury.

EQUIPMENT CONNECTIONS

General: Connect gas piping to each gas fired equipment item with drip leg and shutoff gas cock.
Comply with equipment manufacturer's instructions.
Install any required Step-down pressure regulators that may be required based on gas pressures supplied from gas meter to gas pressure requirements of equipment. Pipe any regulator vents to outside of building away from any O.A. intakes.

FIELD QUALITY CONTROL

Piping Tests: Inspect, test, and purge natural gas systems according to NFPA 54.

ADJUSTING AND CLEANING

Cleaning and Inspecting: Clean and inspect natural gas systems. Paint gas piping per Section 15526

SECTION 15657 BREECHING, CHIMNEYS & STACKS

PART 1 - GENERAL

SECTION INCLUDES

Single wall vents – Stainless Steel.

REFERENCES

Underwriters Laboratories (UL):
UL 441 Standard for Gas Vents

National Fire Protection Association (NFPA):
NFPA 211 Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

American National Standards Institute (ANSI):
ANSI Z223.1 Fuel Gas Code

DESIGN REQUIREMENTS

Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labeled.

PRODUCTS

SINGLE WALL GAS VENTS – (FOR GAS FIRED HEATERS)

Fabricate pipe of AL 29-4C stainless steel, tested in compliance with UL 441

Provide compatible wall fitting and accessories required for installation, UL labeled.

Acceptable Manufacturers: Heat Fab, or equal.

EXECUTION

GENERAL

For gas fired unit heaters, install single wall stainless vent and combustion air from unit up to the connection to combination vent/combustion air vent kits. Utilize stainless on both

the vent and the combustion air intakes. Vent Kit installation and materials as supplied by manufacturer and/or as per manufacturer’s recommendations.

INSTALLATION

Install according to manufacturer's instructions and UL listing.

Install vents of type and materials as recommended by the gas fired heating equipment manufacturer whether addressed in this section or not.

Install according to recommendations of ASHRAE - Handbook, Equipment Volume, Chapter "Chimney, Gas, Vent, and Fireplace Systems", and ANSI Z223.1 (NFPA 54).

Support vent from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling, and to prevent excess loading on equipment vent is serving.

For all gas vents, maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories as required for complete installation.

Level and plumb chimney and stacks.

Clean breechings, chimneys, and stacks during installation, removing dust and debris.

At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, chimneys, or stacks.

PROTECTION

Temporary Closure: At ends of breechings and chimneys, which are not completed or connected to equipment, provide temporary closure that will prevent entrance of dust and debris until installations are completed.

SECTION 15863 FUEL FIRED UNIT HEATERS

PART 1 - GENERAL

SECTION INCLUDES

Natural Gas fired, separated combustion unit heaters - propeller fan type.

REFERENCES

American Gas Association (AGA)

American National Standards Institute (ANSI):
ANSI Z223.1 (NFPA 54) National Fuel Gas Code
ANSI/ASHRAE 103 Heating Seasonal Efficiency of Central Furnaces and Boilers, Method of Testing
ANSI/NFPA 211 Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.

SUBMITTALS

Submit shop drawings according to the General Conditions and Division 1.

PRODUCTS

GAS FIRED SEPARATED COMBUSTION UNIT HEATERS - PROPELLER FAN TYPE

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.

Heat Exchanger: The heater shall be equipped with either a multi-cell, 4-pass serpentine style steel heat exchanger, a 18 gauge aluminized steel tubes and headers if a Modine unit.

If indicated on the Unit Heater Equipment Schedules on the plans, provide unit with the following heat exchanger material type: 409 Stainless Steel heat exchanger.

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.

Controls:

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.

All controls shall be enclosed in the sealed control compartment to protect them from accidental damage, dust, and atmospheric corrosion.

Combustion Air and Venting:

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.

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.

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

Electrical:

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.
Each unit shall be equipped for use with (115/1) voltages as scheduled as plans.
All units will be equipped with a built-in disconnect switch.

Cabinet

The cabinet shall be low profile with a pre-coat or powder coat RAL 1001 white paint 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.
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.
The cabinet shall be equipped with painted, roll-formed horizontal louvers. Louvers shall be spring held and adjustable for directing airflow.
The cabinet shall be equipped with a full safety fan guard with no more than ½ inch grill spacing on sizes 30-125 or no more than 1 inch on sizes 150-400. The enclosed motor and fan assembly shall be resiliently mounted to the cabinet to reduce vibration and noise.
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.
Minimum top clearance from combustibles shall be 1 inch for sizes 30-125 and 4 inches for sizes 150-400. 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 and 2 inches for sizes 150-400.

Low voltage room thermostat to be provided with each unit. Provide space thermostats with readily accessible adjustment devices and 5-degree dead band capability and 55°F night setback capability. Provide thermostats with digital readouts. Provide with adjustable anticipation heater.

Available Unit Heater Manufacturer: Modine, or Sterling.

EXECUTION

EXAMINATION

Verify that space is ready for installation of units and openings are as indicated on shop drawings.

Verify that proper power supply is available.

Verify that proper fuel supply is available for connection.

INSTALLATION

Install according to manufacturer's instructions.

Installed condensate drip leg with drain port on all vents. Drip leg to be sealed water tight. Install CPVC trap and drain line to drain port. Route to nearest drain or out through wall to grade.

Install to NFPA 90A.

Install gas-fired units to ANSI Z223.1 (NFPA 54).

Provide vent connections to ANSI/NFPA 211.

Install unit heaters with vibration isolation.

Install wall mount thermostats where indicated on drawings. Utilize insulated bases on all thermostats. Route Control wiring in Conduit which conforms to Division 16 requirements. Anticipation heater settings to be set as recommended by unit heater manufacturer.

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/combination box.

SECTION 15887 HVAC FANS

PART 1 - GENERAL

WORK INCLUDED

Propeller Fans – Direct Driven.

REFERENCES

Air Movement and Control Association (AMCA):
AMCA 99 Standards Handbook
AMCA 210 Laboratory Methods of Testing Fans for Rating Purposes
AMCA 300 Test Code for Sound Rating Air Moving Devices
AMCA 301 Method of Calculating Fan Sound Ratings from Laboratory Test Data

SUBMITTALS

Submit shop drawings according to the General Conditions and Division 1.

QUALITY ASSURANCE - GENERAL

Performance Ratings: Conform to AMCA 210.

Sound Ratings: AMCA 301, tested to AMCA 300.

Fabrication: Conform to AMCA 99.

PRODUCTS

PROPELLER EXHAUST & SUPPLY FANS - DIRECT DRIVE:

Propellers shall be constructed with fabricated materials as indicated on schedules. A standard square key and set screw or tapered bushing shall lock the propeller to the motor shaft. All propellers shall be statically and dynamically balanced.

Motors shall be permanently lubricated, heavy duty type, carefully matched to the fan load and furnished at the specified rpm, voltage, phase and enclosure.

Motor drive frame assemblies and fan panels shall be painted steel. Drive from assemblies shall be welded wire or formed channels and fan panels shall have pre-punched mounting holes, formed flanges, and a deep formed inlet venturi. Drive frames and panels shall be welded construction.

Fans shall bear the AMCA certified ratings seals for both sound and air performance.

Accessories: Provide fan with accessories as follows or as listed on the equipment schedule included in the drawings:
Hood assembly with bird screen.
Wall collar.
Motor guard.
Premium efficiency motor

Coatings/Finishes: Provide the following coating. Coating should be on fan and all accessories.
All fan and accessory components:
Greenheck; Hi-Pro Polyester Coating with color choice of Industrial Grey.
Loren Cook: Epoxy Phenolic w/ UV top coat Coating with color choice of Light Grey.

Fans shall be as manufactured by Greenheck Fan Corporation, Loran Cook Fan Company, or approved equal.

EXECUTION

INSTALLATION - GENERAL

Install according to manufacturer's instructions.

Coordinate all wall openings with General contractor. Verify final opening requirements with actual fan dimensional data.

Support fan and fan housings utilizing neoprene isolators at all hanging points. Coordinate supports and support anchoring placement with general contractor.

Coordinate electrical requirements. Final electrical connections shall conform to Division 16 requirements. Properly ground equipment.

Make final electrical interlock connections between fan operation power and automatic dampers and electrical accessories provided as part of fan package.

Include any necessary relays, transformers, wiring, conduit, boxes, etc as needed to make the required electrical connections. Electrical work shall conform to Division 16 requirements.

22. Brining Building Electrical, Item SPV.0105.06.

A Description

This special provision describes providing the electrical construction required to complete the Brining Building 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 Brining Building Electrical by the lump sum completed according to the contract and accepted, as a single complete lump sum unit of work.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.06	Brining 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.

INDEX OF ELECTRICAL SPECIFICATIONS

16050 Common Work Results for Electrical
16060 Grounding & Bonding
16075 Identification for Electrical Systems
16118 Underground Ducts and Raceways
16120 Low-Voltage Electrical Power Conductors & Cables
16130 Raceways & Boxes
16140 Wiring Devices
16145 Lighting Control Devices
16190 Hangers & Supports for Electrical Systems
16410 Enclosed Switches & Circuit Breakers
16420 Enclosed Controllers
16442 Panelboards
16461 Low-Voltage Distribution Transformers
16491 Fuses
16511 Interior Lighting
16521 Exterior Lighting

SECTION 16050 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

SUMMARY

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.

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.

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.

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.

The contractor, in conjunction with the engineer, 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.

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.

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.

PERMITS AND LICENSES

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.

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.

Provide a copy of the electrical permit to the owner representative prior to proceeding with any work.

DEFINITIONS

LFMC: Liquidtight flexible metal conduit.

RNC: Rigid nonmetallic conduit.

Provide: Furnish, install and wire complete and ready for service.

Exposed: Exposed to view in any room.

This Contractor: The Electrical Contractor, also referred to as "The Contractor".

The Architect: R.A. Smith National, Inc.

The Engineer: IBC Engineering Services, Inc.

Code: National, State and Local Electrical codes including OSHA requirements.

The Owner: The individual who the owner selects as his project representative.

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.

Substitution: Any manufacturer or method other than those listed by name in these specifications, on the drawings, or in an addendum.

SUBMITTALS

Submit to engineer for review, the manufacturer's shop drawings and/or equipment brochures in quantities determined by the engineer for the following
Panelboards.
Transformers.
Enclosed Switches and Circuit Breakers.
Enclosed Controllers.
Lighting Fixtures.

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.

All data submitted for engineer's review shall be numbered consecutively, shall be noted to correlate with the electrical drawings, and shall bear:
The name and location of the project.
The name of the contractor.
The date of submittal.
The date of the drawings and the date of each correction and revision
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.
Failure to do this, may result in the submittal(s) being returned to the contractor for correction and re-submission.

Failing to follow these instructions does not relieve the contractor from the requirement of meeting the project schedule.

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.

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.

Submit additional materials at the request of the engineer.

Shop drawings shall bear the contractor's stamp indicating approval or approved as noted.

Any equipment fabrication prior to shop drawing review shall be at the contractor's risk.

MAINTENANCE MANUALS

The contractor shall assemble and submit to the engineer for subsequent submission to the owner, three complete sets of a Manual of Operation and Maintenance for each piece of electrical equipment.

Each manual shall consist of a loose leaf bound volume instructing the owner's personnel in the use, operation and maintenance of the equipment 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 it's component parts.

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:
Copies of all reviewed submittals bearing contractor’s stamp indicating approval or approved as noted.
Manufacturer’s wiring diagrams for electrically powered equipment.
Records of tests performed to certify compliance with system requirements.
Certificates of inspection by regulatory agencies.
Parts lists for manufactured equipment.
Preventive maintenance recommendations.
Warranties.
Additional information as indicated in the technical specification sections.

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 01, General Conditions of the Contract, and SUBSTITUTION AND APPROVAL OF MATERIAL, EQUIPMENT OR DESIGN.

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.

Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply

All work and material shall conform with the National Electrical Code (ANSI/NFPA 70).

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 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.

COORDINATION

Coordinate inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.

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.

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.

Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

Coordination Meetings: Attend coordination meetings with the construction manager 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.

Conflicts Between Trades: Resolve all conflicts with trades at no additional cost to the owner or engineer.

INTENT OF DRAWINGS AND SPECIFICATIONS

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 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 engineer before submitting his bid. In lieu of written clarification by addendum, resolve all conflicts in favor of the greater quantity or better quality.

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.

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 engineer’s intent (as determined by the engineer). Refer to the General Conditions of the Contract for further clarification.

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 engineer’s review.

All sizes as given are minimum except as noted.

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.

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.

The contractor shall refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.

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.

DRAWINGS

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.

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.

MATERIAL AND EQUIPMENT

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.

DAMAGE TO OTHER WORK

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 engineer), and all cost thereof shall be borne by the contractor responsible for the damage.

COOPERATION WITH OTHER TRADES

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.

NEGLIGENCE

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.

FIELD CHANGES

Should any change in drawings or specifications be required to comply with local regulations and/or field conditions, the contractor shall refer same to 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 engineer shall be final.

CUTTING AND PATCHING

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.

STANDARDS, CODES AND PERMITS

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.

Conform with other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).

All Division 16 work shall be done under the direction of a currently State Certified Master Electrician.

All materials shall have a U.L. label where a U.L. standard and/or test exists.

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.

Abbreviations of standards organizations referenced in this and other sections are as follows:

ANSI American National Standards Institute
ASTM American Society for Testing and Materials
EPA Environmental Protection Agency
ETL Electrical Testing Laboratories, Inc.
IEEE Institute of Electrical and Electronics Engineers
IES Illuminating Engineering Society
ISA Instrument Society of America
NBS National Bureau of Standards
NEC National Electric Code
NEMA National Electrical Manufacturers Association
NESC National Electrical Safety Code
NFPA National Fire Protection Association
UL Underwriters Laboratories Inc.

CLEAN-UP

Refer to Division 01, General Requirements, Cleaning for additional requirements.

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 engineer may order the removal of such rubbish and charge the cost to the responsible contractor as determined by the 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.

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.

TESTS

General: The contractor shall provide all instrumentation, labor and conduct all tests required by the engineer. 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 engineer or his authorized representative.

System Tests:
Service and building ground tests.
Secondary feeders shall have an insulation resistance test utilizing a megger applying a test potential of 500 volts DC minimum.
Establish secondary phase to ground voltages.
Set transformer taps to deliver nominal rated voltage.
Establish proper phase relationship and motor rotation.

The following tests are required under normal load condition:

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.
Confirm proper phase relationship and motor rotation.
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%.
Reset transformer taps if necessary to deliver nominal rated voltage. Identify final tap settings on transformers nameplates.
Confirm operation of all electrically operated apparatus, such as circuit breakers, transfer switches, etc., by exercising same under load.
Record all settings and calibrations of circuit breakers, transfer switches, transformers, meters, timing devices, etc.

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.

DRAWINGS OF OTHER TRADES

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.

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.

FIELD MEASUREMENTS

The contractor shall take all field measurements necessary for his work and shall assume the full responsibility for their accuracy.

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 engineer, 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.

EXAMINATION OF PLANS, SPECIFICATIONS AND SITE

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 days before bid opening, the contractor shall call the attention of the 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 engineer before submitting his bid. In lieu of written clarification by addendum, resolve all conflicts in favor of the greater quantity or better quality.

GUARANTEE

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/engineer at no additional charge.

SUBSTITUTION AND APPROVAL OF MATERIAL, EQUIPMENT OR DESIGN

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.

The proposed substitution does not affect dimensions shown on Drawings or as specified.

The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.

All proposed substitutions will be subject to satisfactory performance to the specification and considered as a deduct alternate rather than as an equivalent.

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.

All substitution review costs shall be reimbursed to the engineer by the contractor or their suppliers on a Time/Material bases. This cost shall be paid on approval on disproval of the substitution material, equipment or design.

WORKMANSHIP

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.

PRODUCTS

SUPPORTING DEVICES

Material: Stainless steel.

Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches on-center, in webs.

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.

Expansion Anchors: Stainless steel wedge or sleeve type.

Toggle Bolts: Stainless steel springhead type.

CONCRETE BASES

Concrete: 3000-psi, 28-day compressive strength.

TOUCHUP PAINT

For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

EXECUTION

ELECTRICAL EQUIPMENT INSTALLATION

Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

Right-of-Way: Give to raceways and piping systems installed at a required slope.

ELECTRICAL SUPPORTING DEVICE APPLICATION

Damp Locations and Outdoors: Stainless steel U-channel system components.

Install equipment grounding conductors in all feeders and circuits.

Support Clamps for PVC Raceways: Click-type clamp system.

Selection of Supports: Comply with manufacturer's written instructions.

Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

SUPPORT INSTALLATION

Install support devices to securely and permanently fasten and support electrical components.

Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

Support individual horizontal raceways with separate pipe hangers or clamps.

Install 1/4-inch- diameter or larger threaded stainless steel hanger rods, unless otherwise indicated.

Separately support cast boxes that are threaded to raceways and used for fixture support. Support metal boxes directly from the building structure.

Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, and transformers.

Install sleeves for raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for raceway penetrations of masonry walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

Masonry: Stainless steel toggle bolts on hollow masonry units and stainless steel expansion bolts on solid masonry units.

New Concrete: Stainless steel concrete inserts with stainless steel machine screws and bolts.

Light Steel: Stainless steel sheet-metal screws.

Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

FIRESTOPPING

Apply firestopping to raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

CONCRETE BASES

Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

CUTTING AND PATCHING

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

FIELD QUALITY CONTROL

Inspect installed components for damage and faulty work, including the following:
- Raceways
- Building wire and connectors
- Supporting devices for electrical components
- Electrical identification
- Concrete bases
- Cutting and patching for electrical construction
- Touchup painting

REFINISHING AND TOUCHUP PAINTING

Refinish and touch up paint.
Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

CLEANING AND PROTECTION

On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

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 16060 GROUNDING & BONDING

PART 1 - GENERAL

SUMMARY

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.

QUALITY ASSURANCE

Field Test Reports: Submit written test reports to include the following:
Test procedures used.
Test results that comply with requirements.
Results of failed tests and corrective action taken to achieve test results that comply with requirements.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
Comply with UL 467.

Comply with NFPA 70.

COORDINATION

Show location of all service grounding equipment and describe method of grounding installation. Show the following:
Service ground conductor.
Grounding at water meter.
Location of ground rods.

PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Grounding Conductors, Cables, Connectors, and Rods:

Copperweld Corp.
Erico Inc.; Electrical Products Group
Framatome Connectors/Burndy Electrical
Ideal Industries, Inc.
ILSCO
O-Z/Gedney Co.; a business of the EGS Electrical Group
Raco, Inc.; Division of Hubbell
Thomas & Betts, Electrical, a Member of the ABB Group
Or approved equal.

GROUNDING CONDUCTORS

For insulated conductors, comply with Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

Material: Copper.

Equipment Grounding Conductors: Insulated with green-colored insulation.

Grounding Electrode Conductors: Stranded cable.

Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

Bare Copper Conductors: Comply with the following:

Solid Conductors: ASTM B 3.
Assembly of Stranded Conductors: ASTM B 8.
Tinned Conductors: ASTM B 33.

Copper Bonding Conductors: As follows:

Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

CONNECTOR PRODUCTS

Bolted Connectors: Bolted-pressure-type connectors, or compression type.

GROUNDING ELECTRODES

Ground Rods: Copper-clad steel, size ¾ inches in diameter by 10 feet in length.

EXECUTION

APPLICATION

Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

In raceways, use insulated equipment grounding conductors.

Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

Ground Rod Clamps: Use bolted pressure clamps with at least two bolts.

EQUIPMENT GROUNDING CONDUCTORS

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.

Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
Feeders and branch circuits.
Lighting circuits.
Receptacle circuits.
Single-phase motor and appliance branch circuits.
Three-phase motor and appliance branch circuits.
Flexible raceway runs.

Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways.

Water Heater: Install a separate equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

Signal and Communication Systems: For 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 and terminal cabinet.
Service Locations: Terminate grounding conductor on grounding bus.
Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

INSTALLATION

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.
Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
Interconnect ground rods with grounding electrode conductors. Make connections without exposing steel or damaging copper coating.

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.

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.

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.

Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

Bond interior metal piping systems to equipment grounding conductors of associated pumps, fans, blowers, and heaters. Use braided-type bonding straps.

Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

CONNECTIONS

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.

Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

Make connections with clean, bare metal at points of contact.

Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

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.

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.

Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

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.

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.

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.

FIELD QUALITY CONTROL

Testing: Perform the following field quality-control testing:
After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
Test completed grounding system at each location where a maximum ground-resistance level is specified, and at service disconnect. 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.
Equipment Rated 500 kVA and Less: 10 ohms.
Equipment Rated 500 to 1000 kVA: 5 ohms.
Excessive Ground Resistance: If resistance to ground exceeds specified values, notify engineer promptly and include recommendations to reduce ground resistance.

SECTION 16075 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

SUMMARY

This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

QUALITY ASSURANCE

Comply with ANSI C2.

Comply with NFPA 70.

Comply with ANSI A13.1 and NFPA 70 for color-coding.

PRODUCTS

RACEWAY AND CABLE LABELS

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.
Color: Black letters on white field.
Legend: Indicates voltage and service.

Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.

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.

Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
Not less than 6 inches wide by 4 mils thick.
Compounded for permanent direct-burial service.
Embedded continuous metallic strip or core.
Printed legend indicating type of underground line.

Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

NAMEPLATES

Engraved Plastic Nameplates: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for nameplates up to 20 sq. in. and 1/8 inch thick for larger sizes.
Engraved legend with black letters on white face.
Punched or drilled for mechanical fasteners.

Fasteners for Nameplates: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

MISCELLANEOUS IDENTIFICATION PRODUCTS

Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
Minimum Width: 3/16 inch.
Tensile Strength: 50 lb minimum.
Temperature Range: Minus 40 to plus 185 deg F.
Color: According to color-coding.

EXECUTION

INSTALLATION

Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

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.

Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

Self-Adhesive Identification Products: Clean surfaces before applying.

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.

Circuit Identification Labels on Boxes: Install labels externally.
Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic warning tape 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.

Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder phase conductors:
208/120-V Conductors:
Phase A: Black.
Phase B: Red.
Phase C: Blue.
480/277-V Conductors:
Phase A: Brown.
Phase B: Orange.
Phase C: Yellow.
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:
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.

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.

Apply identification to conductors as follows:
Conductors to Be Extended in the Future: Indicate source and circuit numbers.
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.
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.

Apply warning, caution, and instruction signs as follows:
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.

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:
Panelboards
Transformers
Disconnect switches
Motor starters
Push-button stations
Control devices

SECTION 16118 UNDERGROUND DUCTS AND RACEWAYS

PART 1 - GENERAL

SUMMARY

This Section includes the following:

Ducts in direct-buried duct banks.
Ducts in concrete-encased duct banks.
Handholes and handhole accessories.

Related Sections include the following:
Division 16 Section “Common Work Results for Electrical" for supports, anchors, and identification products.
Division 16 Section “Grounding and Bonding for Electrical Systems" for grounding conductors, and testing of grounds.

SUBMITTALS

Product Data: For the following:
Handholes.
Underground warning tape.

QUALITY ASSURANCE

Electrical Components, Devices, and Accessories (Including Ducts for Communications and Telephone Service): Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with ANSI C2.

Comply with NFPA 70.

DELIVERY, STORAGE, AND HANDLING

Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

Lift and support polymer-concrete handholes only at designated lifting or supporting points.

PROJECT CONDITIONS

Existing Utilities: Do not interrupt utilities serving facilities occupied by owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.
Notify engineer and owner at least two days in advance of proposed utility interruptions.
Do not proceed with utility interruptions without engineer's or owner’s written permission.

COORDINATION

Coordinate layout and installation of ducts and handholes with final arrangement of other utilities and site grading, as determined in the field.

Coordinate elevations of ducts and duct-bank entrances into handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations as required to suit field conditions and to ensure duct runs drain to handholes.

PRODUCTS

PRODUCTS AND MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
Underground Precast Polymer Concrete Utility Structures:
Quazite/Hubbell Power Systems
Or approved equal.
Nonmetallic Ducts and Accessories:
Cantex, Inc.

Certainteed Corp.; Pipe & Plastics Group
Lamson & Sessions; Carlon Electrical Products
Or approved equal.

CONDUIT

Conduit and fittings are specified in Division 16 Section "Raceways and Boxes for Electrical Systems."

DUCTS

Rigid Nonmetallic Conduit: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

Rigid Nonmetallic Conduit: NEMA TC 2, Type EPC-80-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

HANDHOLES

Polymer Concrete Handholes: Molded fiberglass reinforced precast polymer concrete, with cable entrance at each end and gasketed heavy-duty bolted cover with nonskid finish and legend. Unit, when buried, shall be designed to support ANSI/SCTE 77 Tier 15 loading for driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic.

Cover Legend: "ELECTRIC" for power circuits 600V and less, or “COMMUNICATIONS” for low voltage telephone, data, or fiber optic cables.

ACCESSORIES

Duct Spacers: Rigid PVC interlocking spacers, selected to provide minimum duct spacings and cover depths indicated while supporting ducts during concreting and backfilling; produced by the same manufacturer as the ducts.

Grounding Materials: Comply with Division 16 Section "Grounding and Bonding for Electrical Systems."

Warning Tape: Underground-line warning tape specified in Division 16 Section " Identification for Electrical Systems."

EXECUTION

APPLICATION

Underground Ducts for Electrical Feeders and Branch Circuits: Type EPC-40-PVC, direct-buried duct bank, except use Type EPC-40-PVC concrete encased duct bank or Type EPC-80-PVC direct buried duct bank when crossing roads and traffic areas of parking lots.

Underground Ducts for Communication Circuits: Type EPC-40-PVC, direct-buried duct bank, except use Type EPC-40-PVC concrete encased duct bank or Type EPC-80-PVC direct buried duct bank when crossing roads and traffic areas of parking lots.

Handholes: Underground precast polymer-concrete utility structures.

EARTHWORK

Excavation and Backfill: Use excavated material as backfill, but do not use heavy-duty, hydraulic-operated, compaction equipment.

Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

Restore disturbed pavement.

CONDUIT AND DUCT INSTALLATION

Slope: Pitch ducts a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two handholes to drain in both directions.

Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. Use long sweep bends at other locations.

Use solvent-cement joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

Building Entrances: Make a transition from underground duct to conduit at least 10 feet outside the building wall. Use fittings manufactured for this purpose. Follow the appropriate installation instructions below:

Concrete-Encased Ducts: Install reinforcement in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.

Direct-Buried, Non-encased Ducts at Nonwaterproofed Wall Penetrations: Install a Schedule 40, galvanized steel pipe sleeve for each duct. Calk space between conduit and sleeve with duct-sealing compound on both sides for moisture-tight seal.

Waterproofed Wall and Floor Penetrations: Install a watertight entrance-sealing device with sealing gland assembly on the inside. Anchor device into masonry construction with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.

Concrete-Encased, Nonmetallic Ducts: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

- Separator Installation: Space separators close enough to prevent sagging and deforming of ducts and secure separators to earth and to ducts to prevent floating during concreting. Stagger spacers approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application. Pour each run of envelope between handholes or other terminations in one continuous operation. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
- Reinforcement: Reinforce duct banks where they cross disturbed earth and where indicated.
- Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
- Minimum Clearances between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
- Depth: Install top of duct bank at least 24 inches below finished grade in nontraffic areas and at least 30 inches below finished grade in vehicular traffic areas, unless otherwise indicated.

Direct-Buried Ducts: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

- Separator Installation: Space separators close enough to prevent sagging and deforming of ducts.
- Trench Bottom: Continuous, firm, and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 “Earthwork" for pipes less than 6 inches in nominal diameter.
- Backfill: Install backfill as specified in Division 31 “earthwork." After installing first tier of ducts, backfill and compact. Repeat backfilling after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, complete backfilling normally.
- Minimum Clearances between Ducts: 3 inches between ducts for like services and 6 inches between power and signal ducts.
- Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.

Warning Tape: Bury warning tape approximately 6 to 8 inches below finished grade. Align tape parallel to and within 3 inches of the centerline of duct bank.

Stub-ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete bases, extend steel conduit a minimum of 5 feet from edge of base. Install insulated grounding bushings on terminations. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete.

Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

HANDHOLE INSTALLATION

Install handholes with top of handhole set 1 inch above grade.

Drainage: Polymer concrete handholes to have open bottoms. Set handholes on a 12-inch minimum bed of gravel to allow for drainage.

FIELD QUALITY CONTROL

Testing: Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

Duct Integrity: Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of the duct. If obstructions are indicated, remove obstructions and retest.

Correct installations if possible and retest to demonstrate compliance. Remove and replace defective products and retest.

CLEANING

Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

Clean internal surfaces of handholes. Remove foreign material.

SECTION 16120 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

PART 1 - GENERAL

SUMMARY

This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

CONDUCTORS AND CABLES

Manufacturers:
American Insulated Wire Corp.; a Leviton Company
General Cable Corporation
Senator Wire & Cable Company
Southwire Company
Or approved equal.

Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

Conductor Material: Copper complying with NEMA WC 70/ICEA S-95-658.

Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type XHHW-2.

CONNECTORS AND SPLICES

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:
AFC Cable Systems, Inc.
AMP Incorporated/Tyco International
Gardner Bender
Ideal Industries, Inc.
3M Company; Electrical Products Division
Or approved equal.

Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

EXECUTION

CONDUCTOR MATERIAL APPLICATIONS

Feeders: Copper.

Branch Circuits: Copper.

CONDUCTOR AND INSULATION APPLICATIONS

Exposed Feeders: Type XHHW-2, single conductors in raceway.

Feeders Concealed in Concrete, and below Slabs-on-Grade: Type XHHW-2, single conductors in raceway.

Exposed Branch Circuits: Type XHHW-2, single conductors in raceway.

Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type XHHW-2N, single conductors in raceway.

Underground Feeders and Branch Circuits: Type XHHW-2, single conductors in raceway. No. 10 AWG minimum size.

Branch circuit conductors installed inside light poles: Type XLP/RHW, single conductors.

Class 1 Control Circuits: Type XHHW-2, in raceway.

Class 2 Control Circuits: Type XHHW-2, in raceway.

INSTALLATION

Do not use conductor smaller than No. 12 AWG for power and lighting circuits.

All conductors and cables shall be installed in conduit.

Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables.

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.

Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

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 not exceeding three percent.

Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

Support cables according to Division 16 Section "Hangers and Supports for Electrical Systems."

Seal around cables penetrating fire-rated elements.

Identify and color-code conductors and cables according to Division 16 Section " Identification for Electrical Systems."

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.
As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).

CONNECTIONS

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.

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.

Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

Splices are not allowed in underground feeders and branch circuits, except at junction boxes within the buildings or at light pole handholes.

IDENTIFICATION

Identify and color-code conductors and cables according to Section 16075 "Identification for Electrical Systems."

Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

FIRESTOPPING

Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

FIELD QUALITY CONTROL

Testing: Perform the following field quality-control testing:
After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

Test Reports: Prepare a written report to record the following:
Test procedures used.
Test results that comply with requirements.
Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

Cables will be considered defective if they do not pass tests and inspections.

SECTION 16130 RACEWAYS & BOXES

PART 1 - GENERAL

SUMMARY

Section Includes:
Metal conduits, tubing, and fittings.
Nonmetal conduits, and fittings.
Boxes and enclosures.

Related Requirements:
Section 16190 “Hangers and Supports for Electrical Systems” for supports, anchors, and attachment components for raceways, boxes, enclosures, and cabinets.
Section 16140 “Wiring Devices” for devices installed in boxes.

DEFINITIONS

GRC: Galvanized rigid steel conduit.

LFMC: Liquidtight flexible metal conduit.

PVC: Polyvinyl chloride.

RNC: Rigid non-metallic conduit.

ACTION SUBMITTALS

Product Data: For hinged-cover enclosures.

PRODUCTS

METAL CONDUITS, TUBING, AND FITTINGS

Manufacturers: Subject to compliance with requirements, provide products by the following:
AFC Cable Systems, Inc.
Allied Tube & Conduit; a Tyco International Ltd. Co.
Electri-Flex Company
O-Z/Gedney; a brand of EGS Electrical Group
Republic Conduit
Thomas & Betts Corporation
Western Tube and Conduit Corporation
Wheatland Tube Company; a division of John Maneely Company
Or approved equal.

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.

GRC: Comply with ANSI C80.1 and UL 6.

LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
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.

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.

NONMETALLIC CONDUITS AND FITTINGS

Manufacturers: Subject to compliance with requirements, provide products by the following:
AFC Cable Systems, Inc.
Anamet Electrical, Inc.
CANTEX Inc.
CertainTeed Corp.
Lamson & Sessions; Carlon Electrical Products
RACO; a Hubbell company
Thomas & Betts Corporation
Or approved equal.

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.

RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

Fittings for RNC: Comply with NEMA TC 3; match to conduit type and material.

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).

BOXES, ENCLOSURES, AND CABINETS

Manufacturers: Subject to compliance with requirements, provide products by the following:
Cooper Technologies Company; Cooper Crouse-Hinds
EGS/Appleton Electric
Hoffman; a Pentair company
RACO; a Hubbell Company
Spring City Electrical Manufacturing Company
Thomas & Betts Corporation
Or approved equal.

General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

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.

Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

Device Box Dimensions:
Single-gang box: 4 inches by 2-1/8 inches by 2-1/8 inches deep.
Double-gang box: 4 inches square by 2-1/8 inches deep.

Gangable boxes are prohibited.

Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250 with continuous-hinge cover.
Metal Enclosures, Type 4X: Stainless steel.
Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

EXECUTION

RACEWAY APPLICATION

Outdoors: Apply raceway products as specified below unless otherwise indicated:
Exposed Conduit: GRC.
Underground Conduit: RNC, Type EPC-40-PVC direct buried or concrete encased, or Type EPC-80-PVC direct buried.
Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.

Indoors: Apply raceway products as specified below unless otherwise indicated:
Exposed, inside the Brining Facility and the Salt Storage Barn: RNC.
Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
Boxes and Enclosures: NEMA 250, Type 4X stainless steel, or nonmetallic.

Minimum Raceway Size: 3/4-inch trade size.

Raceway Fittings: Compatible with raceways and suitable for use and location.
Rigid Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

INSTALLATION

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.

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.

Complete raceway installation before starting conductor installation. Install temporary closures to prevent foreign matter from entering raceways.

Comply with requirements in Section 16190 "Hangers and Supports for Electrical Systems" for hangers and supports.

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.

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.

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.

Install exposed conduits parallel or perpendicular to building lines.

Support conduit within 12 inches of enclosures to which attached.

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.

Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

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.

Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

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.

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.

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.

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.

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:

Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

Where an underground service raceway enters a building or structure.

Where otherwise required by NFPA 70.

Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Expansion-Joint Fittings:

Install in each run of aboveground GRC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

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.

Install expansion fittings at all locations where conduits cross building or structure expansion joints.

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.

Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement, and for all transformers and motors.

Use LFMC in damp or wet locations.

Install a separate ground conductor within all flexible conduit connections.

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.

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.

Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

INSTALLATION OF UNDERGROUND CONDUIT

Direct-Buried Conduit:
Excavate trench bottom to provide firm and uniform support for conduit.
Install backfill.
After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
Install manufactured rigid steel conduit elbows for stub-ups at equipment and at building entrances through floor.
Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
Underground Warning Tape: Comply with requirements in Section 16075 "Identification for Electrical Systems."

PROTECTION

Protect coatings, finishes, and cabinets from damage and deterioration.
Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

SECTION 16140 WIRING DEVICES

PART 1 - GENERAL

SUMMARY

This Section includes the following:
Duplex receptacles, ground-fault circuit interrupters, and weather resistant receptacles.
Single-, and double-pole toggle switches.
Device cover plates.

DEFINITIONS

GFCI: Ground-fault circuit interrupter.

PVC: Polyvinyl chloride.

QUALITY ASSURANCE

Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

COORDINATION

Receptacles for Owner-Furnished Equipment: Match plug configurations.

PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
Wiring Devices:
Cooper Wiring Devices
Hubbell Incorporated; Wiring Device-Kellems
Leviton Mfg. Company Inc.
Pass & Seymour/Legrand
Or approved equal.

RECEPTACLES

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.

Weather Resistant Receptacles: Straight blade, 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.

SWITCHES

Single- and Double-Pole Switches: 120/277 V, 20 A; Comply with Fed. Spec. W-C-896F and UL 20.

Toggle Switches: Heavy -Duty grade, quiet type.

COVER PLATES

Single and combination types to match corresponding wiring devices.
Plate-Securing Screws: Stainless steel.
Receptacle Covers for weatherproof GFCI Receptacles: Die cast aluminum, listed and labeled for use in wet locations while “In Use”.

FINISHES

Color:
Wiring Devices: Gray, unless another color is selected by engineer, or required by NFPA 70.

EXECUTION

INSTALLATION

Install devices and assemblies level, plumb, and square with building lines.

Wrap wiring devices with insulating tape before installing and placing plates.

Arrangement of Devices: Unless otherwise indicated, mount with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

All 20-ampere, 125- and 250-volt nonlocking receptacles installed in damp and wet locations shall be a listed weather-resistant type.

IDENTIFICATION

Comply with Division 16 Section " Identification for Electrical Systems."
Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering nameplate on front of cover plate, and durable wire markers or tags inside outlet boxes.

CONNECTIONS

Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."

Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

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.

FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:
After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

Remove malfunctioning units, replace with new units, and retest as specified above.

SECTION 16145 LIGHTING CONTROL DEVICES

PART 1 - GENERAL

SUMMARY

This Section includes the following lighting control devices:
Outdoor photoelectric switches.
Multipole contactors.

Related Sections include the following:
Division 16 Section "Wiring Devices" for manual light switches.

SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings: Show installation details.
Interconnection diagrams showing field-installed wiring.

Field quality-control test reports.

Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PRODUCTS

MANUFACTURERS

Subject to compliance with requirements, provide products by one of the manufacturers specified.

GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

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.

OUTDOOR PHOTOELECTRIC SWITCHES

Manufacturers:
Intermatic, Inc.
Paragon Electric Co.

TORK

Description: Solid state, with DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; and complying with UL 773.
Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
Time Delay: 15-second minimum, to prevent false operation.
Lightning Arrester: Air-gap type.
Mounting: Provide with stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

MULTIPOLE CONTACTORS

Manufacturers:
Allen-Bradley/Rockwell Automation
Cutler-Hammer; Eaton Corporation
GE Industrial Systems
Square D
Or approved equal.

Description: Electrically operated and electrically held, complying with NEMA ICS 2 and UL 508.
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).
Control-Coil Voltage: Match control power source.

CONDUCTORS AND CABLES

Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

EXECUTION

EXAMINATION

Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

Proceed with installation only after unsatisfactory conditions have been corrected.

SENSOR INSTALLATION

Comply with NECA 1.

Install and aim sensors, as specified in manufacturer's written instructions.

WIRING INSTALLATION

Wiring Method: Comply with Division 16 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

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.

Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

Splices, Taps, and Terminations: Make connections only on 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 and UL 486B.

IDENTIFICATION

Identify components and power and control wiring according to Division 16 Section "Identification for Electrical Systems."

Label contactors with a unique designation.

FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:

After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

Operational Test: Verify actuation of each sensor and adjust time delays.

Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

Additional testing and inspecting, at contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

SECTION 16190 HANGERS & SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

SUMMARY

This Section includes the following:
Hangers and supports for electrical equipment and systems.
Construction requirements for concrete bases.

DEFINITIONS

RMC: Rigid metal conduit.

PERFORMANCE REQUIREMENTS

Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

QUALITY ASSURANCE

Comply with NFPA 70.

COORDINATION

Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

PRODUCTS

SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

Stainless Steel Slotted Support Systems: Factory-fabricated components for field assembly.
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:
- Allied Tube & Conduit
- Cooper B-Line, Inc.; a division of Cooper Industries
- ERICO International Corporation
- Thomas & Betts Corporation
- Unistrut; Tyco International, Ltd.
- Or approved equal.

Metallic Coatings: Steel slotted support channels for use outdoors or in damp locations shall be stainless steel.
Channel Dimensions: Selected for applicable load criteria.

Raceway and Cable Supports: As described in NECA 1 and NECA 101.

Conduit and Cable Support Devices: Stainless steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars.

Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
Mechanical-Expansion Anchors: Insert-wedge-type, 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.
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:
Cooper B-Line, Inc.; a division of Cooper Industries
Empire Tool and Manufacturing Co., Inc.
Hilti Inc.
ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
MKT Fastening, LLC
Or approved equal.
Clamps for Attachment to Steel Structural Elements: Stainless steel, type suitable for attached structural element.
Through Bolts: Stainless steel, structural type, hex head, and high strength.
Toggle Bolts: Stainless steel springhead type.
Hanger Rods: Threaded stainless steel.

FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

Description: Welded or bolted, stainless steel shapes, shop or field fabricated to fit dimensions of supported equipment.

EXECUTION

APPLICATION

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.

Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

Multiple Raceways or Cables: Install trapeze-type supports fabricated with stainless steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

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 for fastening raceways to trapeze supports.

SUPPORT INSTALLATION

Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, as permitted in NFPA 70.

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.

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:
To New Concrete: Bolt to concrete inserts.
To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
To Steel: Stainless steel beam clamps, or spring-tension clamps.
To Light Steel: Stainless steel sheet metal screws.
Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on stainless steel slotted-channel racks attached to wall.

Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

INSTALLATION OF FABRICATED METAL SUPPORTS

Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

Field Welding: Comply with AWS D1.1/D1.1M.

CONCRETE BASES

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.

Use **3000-psi**, 28-day compressive-strength concrete.

Anchor equipment to concrete base.
Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
Install anchor bolts to elevations required for proper attachment to supported equipment.
Install anchor bolts according to anchor-bolt manufacturer's written instructions.

PAINTING

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. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

Touchup: Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

SECTION 16410 ENCLOSED SWITCHES & CIRCUIT BREAKERS

PART 1 - GENERAL

SUMMARY

This Section includes individually mounted enclosed switches and circuit breakers used for the following:
Motor and equipment disconnecting means.

Related Sections include the following:
Division 16 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
Division 16 Section "Fuses" for fusible devices.

DEFINITIONS

GFCI: Ground-fault circuit interrupter.

SUBMITTALS

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.

Shop Drawings: For each switch and circuit breaker.
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:
Enclosure types and details.
Current and voltage ratings.
Short-circuit current rating.
UL listing for series rating of installed devices.
Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

Field Test Reports: Submit written test reports and include the following:
Test procedures used.
Test results that comply with requirements.

Results of failed tests and corrective action taken to achieve test results that comply with requirements.

Manufacturer's field service report.

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 “General Requirements," include the following:
Routine maintenance requirements for components.
Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
Time-current curves, including selectable ranges for each type of circuit breaker.

QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NEMA AB 1 and NEMA KS 1.

Comply with NFPA 70.

PROJECT CONDITIONS

Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
Altitude: Not exceeding 6600 feet.

COORDINATION

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.

PRODUCTS

MANUFACTURERS

Subject to compliance with requirements, provide products by one of the following:
Eaton Electrical Inc.; Cutler-Hammer Business Unit
General Electric Company; GE Consumer & Industrial – Electrical Distribution
Siemens Energy & Automation, Inc.
Square D Co.; a brand of Schneider Electric
Or approved equal.

ENCLOSED SWITCHES

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.

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.

Accessories:
Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

ENCLOSED CIRCUIT BREAKERS

Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

ENCLOSURES

NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
Outdoor Locations: NEMA 250, Type 4X, stainless steel.
Wet or Damp Indoor Locations: NEMA 250, Type 4X, stainless steel.

EXECUTION

EXAMINATION

Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION

Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.

Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

IDENTIFICATION

Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Identification for Electrical Systems."

Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant stainless steel screws, as specified in Division 16 Section “Identification for Electrical Systems.”

CONNECTIONS

Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.

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.

FIELD QUALITY CONTROL

Prepare for acceptance tests as follows:
Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
Test continuity of each line- and load-side circuit.
Inspect mechanical and electrical connections.
Verify rating of installed fuses.

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:
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.
Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

ADJUSTING

Set field-adjustable switches and circuit-breaker trip ranges.

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 16420 ENCLOSED CONTROLLERS

PART 1 - GENERAL

SUMMARY

This Section includes ac general-purpose controllers rated 600 V and less that are supplied as enclosed units.

Related Sections include the following:

Division 16 Section "Fuses" for fuses to be used in combination controllers with fusible disconnect switch.

SUBMITTALS

Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

Shop Drawings: For each enclosed controller.
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:
Enclosure types and details.
Nameplate legends.
Short-circuit current rating of integrated unit.
UL listing for series rating of overcurrent protective devices in combination controllers.
Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

Field Test Reports: Written reports specified in Part 3.

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 “General Requirements," include the following:
Routine maintenance requirements for enclosed controllers and all installed components.
Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

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.

QUALITY ASSURANCE

Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

DELIVERY, STORAGE, AND HANDLING

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.

PROJECT CONDITIONS

Existing Utilities: Do not interrupt utilities serving facilities occupied by owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
Notify engineer and owner at least two days in advance of proposed utility interruptions.
Identify extent and duration of utility interruptions.
Indicate method of providing temporary utilities.
Do not proceed with utility interruptions without engineer's or owner's written permission.

COORDINATION

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.

Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

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.

PRODUCTS

MANUFACTURERS

Subject to compliance with requirements, provide products by one of the following:
Eaton Electrical Inc.; Cutler-Hammer Business Unit
General Electric Company; GE Consumer & Industrial – Electrical Distribution
Rockwell Automation, Inc.; Allen-Bradley brand
Square D Co.; a brand of Schneider Electric
Or approved equal.

MANUAL ENCLOSED CONTROLLERS

Description: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.

MAGNETIC ENCLOSED CONTROLLERS

Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

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.

Combination Controller: Factory-assembled combination controller and disconnect switch.
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.
Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

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.

ENCLOSURES

Description: NEMA ICS 6, to comply with environmental conditions at installed location.
Outdoor Locations: NEMA 250, Type 4X, stainless steel.
Wet or Damp Indoor Locations: NEMA 250, Type 4X, stainless steel.

ACCESSORIES

Devices shall be factory installed in controller enclosure, unless otherwise indicated.

Pilot Lights, Hand-Off-Auto Selector Switches, and Reset Push-Button Stations: NEMA ICS 2, heavy-duty, oiltight type.

(2) N.O. and (1) N.C. auxiliary contacts.

External overload reset push button.

Control Relays: Auxiliary and adjustable time-delay relays, as noted on drawings.

FACTORY FINISHES

Finish: Stainless steel.

EXECUTION

EXAMINATION

Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.

Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

Proceed with installation only after unsatisfactory conditions have been corrected.

APPLICATIONS

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.

Select horsepower rating of controllers to suit motor controlled.

INSTALLATION

Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 16190 "Hangers and Supports for Electrical Systems.

Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 16 Section "Fuses."

IDENTIFICATION

Identify enclosed controller components and control wiring according to Division 16 Section "Identification for Electrical Systems."
Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
Label each enclosure with engraved nameplate.
Label each enclosure-mounted control and pilot device.

CONTROL WIRING INSTALLATION

Install wiring between enclosed controllers according to Division 16 Section "Low-Voltage Electric Power Conductors and Cables."

Bundle, train, and support wiring in enclosures.

Connect hand-off-automatic switch and other automatic-control devices where applicable.
Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
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.

CONNECTIONS

Conduit installation requirements are specified in Division 16 Section “Raceways and Boxes for Electrical Systems.”

Ground equipment.

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.

FIELD QUALITY CONTROL

Prepare for acceptance tests as follows:
Test insulation resistance for each enclosed controller bus, component, connecting supply, feeder, and control circuit.
Test continuity of each circuit.

Testing: Perform the following field tests and inspections, and prepare test reports:

Perform each electrical test and visual and mechanical inspection indicated in NETA ATS, Sections 7.5, 7.6, and 7.16.
Certify compliance with test parameters.
Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

Test Reports: Prepare a written report to record the following:
Test procedures used.
Test results that comply with requirements.
Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

CLEANING

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.

STARTUP SERVICE

Verify that enclosed controllers are installed and connected according to the Contract Documents.

Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.

Complete installation and startup checks according to manufacturer's written instructions.

DEMONSTRATION

Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.
Train owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
Review data in maintenance manuals. Refer to Division 01 “General Requirements."
Schedule training with owner, through engineer, with at least seven days' advance notice.

SECTION 16442 PANELBOARDS

PART 1 - GENERAL

SUMMARY

This Section includes the following:
Distribution panelboards.
Lighting and appliance branch-circuit panelboards.

DEFINITIONS

GFCI: Ground-fault circuit interrupter.

SUBMITTALS

Product Data: For each type of panelboard, overcurrent protective devices, accessories, and components indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

Shop Drawings: For each panelboard and related equipment.
Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
Enclosure types and details.
Bus configuration, current, and voltage ratings.
Short-circuit current rating of panelboards and overcurrent protective devices.
Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
Wiring Diagrams: Power, signal, and control wiring.
Test procedures used.
Test results that comply with requirements.
Results of failed tests and corrective action taken to achieve test results that comply with requirements.

Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 "General Requirements," include the following:
Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

QUALITY ASSURANCE

Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NEMA PB 1.

Comply with NFPA 70.

PROJECT CONDITIONS

Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
Notify engineer and owner no fewer than two days in advance of proposed interruption of electrical service.
Do not proceed with interruption of electrical service without engineer's or owner’s written permission.

COORDINATION

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.

PRODUCTS

MANUFACTURERS

Subject to compliance with requirements, provide products by one of the following:
Eaton Electrical Inc.; Cutler-Hammer Business Unit
General Electric Company; GE Consumer & Industrial – Electrical Distribution
Siemens Energy & Automation, Inc.
Square D; a brand of Schneider Electric
Or approved equal.

Basis of Design: Square D, Schneider Electric, Type NQ, NF and I-Line.

MANUFACTURED UNITS

Enclosures: Surface-mounted cabinets. NEMA PB 1. Rated for environmental conditions at installed location.

Other Wet or Damp Indoor Locations: NEMA 250, Type 4X.
Finish: Manufacturer's factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
Panelboard Circuit Directory: Removable plastic sleeve, mounted inside panelboard door.

Phase and Ground Buses:
Material: Hard-drawn copper, 98 percent conductivity.
Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

Conductor Connectors: Suitable for use with conductor material.
Main and Neutral Lugs: Mechanical type.
Ground Lugs and Bus Configured Terminators: Mechanical type.

Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

Service Equipment Label: NRTL labeled for use as service equipment.

PANELBOARD SHORT-CIRCUIT RATING

Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

DISTRIBUTION PANELBOARDS

Doors: Secured with vault-type latch with tumbler lock; keyed alike.

Main Overcurrent Protective Devices: Circuit Breaker.

Branch Overcurrent Protective Devices:
For Circuit Breaker Frame Sizes 125A and Smaller: Bolt-on circuit breakers.
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.

LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

Mains: Circuit breaker or Main Lugs, as noted in the panel schedules.

Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

OVERCURRENT PROTECTIVE DEVICES

Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
GFCI Circuit Breakers: Single- and two-pole configurations with **5-30**mA trip sensitivity.

Molded-Case Circuit-Breaker Features and Accessories:
Standard frame sizes, trip ratings, and number of poles.
Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

EXECUTION

INSTALLATION

Install panelboards and accessories according to NEMA PB 1.1.

Mount top of trim 74 inches above finished floor, unless otherwise indicated.

Mount plumb and rigid without distortion of box.

Install overcurrent protective devices and controllers.
Set field-adjustable switches and circuit-breaker trip ranges.

Install filler plates in unused spaces.

Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

IDENTIFICATION

Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section " Identification for Electrical Systems."

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.

Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant stainless steel screws.

CONNECTIONS

Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."

Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

FIELD QUALITY CONTROL

Prepare for acceptance tests as follows:
- Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
- Test continuity of each circuit.

Perform the following field tests and inspections and prepare test reports:
- 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.
- Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

Measure as directed during period of normal system loading.

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.

After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

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.

CLEANING

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 16461 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

SUMMARY

This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
Distribution transformers.

SUBMITTALS

Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

Shop Drawings: Wiring and connection diagrams.
Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Source quality-control test reports.

Output Settings Reports: Record of tap adjustments specified in Part 3.

QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with IEEE C 57.12.91.

Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

DELIVERY, STORAGE, AND HANDLING

Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

COORDINATION

Coordinate installation of wall-mounting and structure-hanging supports.

PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
Eaton Corporation; Cutler-Hammer Products
General Electric Company
Siemens Energy & Automation, Inc.
Square D; Schneider Electric
Or approved equal.

MATERIALS

Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

Cores: Grain-oriented, non-aging silicon steel.

Coils: Continuous windings without splices, except for taps.
Internal Coil Connections: Brazed or pressure type.
Coil Material: Copper.

DISTRIBUTION TRANSFORMERS

Dry- type energy efficient transformers per NEMA TP-1 with primary and secondary voltages of 600V and less capacity ratings 15 KVA through 500 KVA. Comply with NEMA ST 20, and list and label as complying with UL 506 or UL 1561.

Cores: One leg per phase.

Enclosure: Non-Ventilated, IP55 Rated.

Transformer Enclosure Finish: Comply with NEMA 250.

Insulation Class for ventilated transformers: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

Wall Brackets: Manufacturer's standard brackets.

Low-Sound-Level Requirements: Maximum sound levels, when factory tested according to IEEE C57.12.91, as follows:
9 kVA and Less: 40 dB
30 to 50 kVA: 45dB
51 to 150 kVA: 50dB

IDENTIFICATION DEVICES

Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 16075 "Identification for Electrical Systems."

SOURCE QUALITY CONTROL

Test and inspect transformers according to IEEE C57.12.91.

Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

EXECUTION

EXAMINATION

Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

Verify that ground connections are in place and requirements in Section 16060 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION

Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
Brace wall-mounting transformers as specified

Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit and 4 inches high.
Anchor transformers to concrete bases according to manufacturer's written instructions.

CONNECTIONS

Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."

Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

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.

ADJUSTING

Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

Output Settings Report: Prepare a written report recording output voltages and tap settings.

SECTION 16491 FUSES

PART 1 - GENERAL

SUMMARY

This Section includes cartridge fuses, rated 600 V and less, for use in enclosed switches and enclosed controllers.

QUALITY ASSURANCE

Source Limitations: Provide fuses from a single manufacturer.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NEMA FU 1.

Comply with NFPA 70.

PROJECT CONDITIONS

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.

COORDINATION

Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
Cooper Industries, Inc.; Bussmann Div.
Eagle Electric Mfg. Co., Inc.
Ferraz Shawmut, Inc.
Littelfuse, Inc.
Or approved equal.

CARTRIDGE FUSES

Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

EXECUTION

EXAMINATION

Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

Proceed with installation only after unsatisfactory conditions have been corrected.

FUSE APPLICATIONS

Motor Branch Circuits: Class RK5, time delay.

Other Branch Circuits: Class RK5, time delay.

Control Circuits: Class CC, fast acting.

INSTALLATION

Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

IDENTIFICATION

Install labels complying with requirements for identification specified in Section 16075 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

SECTION 16511 INTERIOR LIGHTING

PART 1 - GENERAL

SUMMARY

This Section includes the following:
Interior lighting fixtures with LED lamps and drivers
Lighting fixtures mounted on exterior building surfaces
Emergency lighting units
Exit signs

Related Sections include the following:
Division 16 Section "Wiring Devices" for manual light switches.

Division 16 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, and multipole lighting relays and contactors.

DEFINITIONS

CRI: Color rendering index.

CCT: Correlated color temperature.

CU: Coefficient of utilization.

LPW: Luminaire per watt, system efficacy.

RCR: Room cavity ratio.

LED: Light emitting diode.

L_{70}: Lumen depreciation to 70% of initial lumen output.

SUBMITTALS

In conjunction with the interior lighting submittal provide, simultaneously, the lighting control submittal package, as indicated in Division 16 Section “Lighting Control Devices” specification section.

Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
Physical description of fixture, including dimensions and verification of indicated parameters.
Emergency lighting unit battery and charger.
Complete fixture catalog number designation.
LED:
CCT, CRI
Delivered lumen output
Driver
Drive current
LPW
Photometric data

Wiring Diagrams: Power, signal, and control wiring.

Field quality-control test reports.

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, include the following:
Catalog data for each fixture. Include the diffuser, lamps, and driver installed in that fixture.

Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

COORDINATION

Coordinate layout and installation of lighting fixtures and suspension system with other construction, including HVAC equipment.

WARRANTY

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.
Warranty Period: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

Warranty for LED: Manufacturer agrees to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
Warranty Period: Five years from date of Substantial Completion.

PRODUCTS

LIGHTING FIXTURES

Fixtures and Components, General:
Metal Parts: Free of burrs and sharp corners and edges.
Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
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.
Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
White Surfaces: 85 percent.
Specular Surfaces: 83 percent.
Diffusing Specular Surfaces: 75 percent.
Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
Lens Thickness: At least 0.125 inch minimum unless different thickness is scheduled.
UV stabilized.

For all luminaires provide the product specified in the lighting schedule.

EXIT SIGNS

General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

Internally Lighted Signs:
Lamps for AC Operation: Light-emitting diodes (LED), 70,000 hours minimum of rated lamp life.
No greater that 5 input watts per face.

Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
Charger: Fully automatic, solid-state type with sealed transfer relay.
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.
Light-emitting diodes (LED), 70,000 hours minimum of rated lamp life.

LED LUMINAIRES

Maintain color consistency and light intensity across multiple fixtures of the same designation and those with the same family.

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.

LED LIGHT SOURCES (LED PACKAGES, ARAYS OR MODULES)

Minimum Color Rendering Index of 70.

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.

Efficacy: 80 Lumens per watt unless otherwise indicated.

L_{70}: 50,000 hours minimum.

CCT: 4000-4100K, or as indicated.

LED POWER SUPPY

Performance Requirements:
Operate LED's within the current limit specifications for the LED manufacturer.
Operate at 60Hz input source and have input power factor above 90% and a minimum efficiency of 70% at full rated load of the driver.
Provide short circuit and overload protection.

Regulatory Requirements:
Contain no PCB's (polychlorinated biphenyl).
Comply with IEEE C.62.41-1991, Class A operation.
Be UL1310/8750 recognized when used in conjunction with a UL listed luminaire.

FIXTURE SUPPORT COMPONENTS

Comply with Division 16 Section "Common Work Results for Electrical" for channel- and angle-iron supports.

Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

Rod Hangers: 3/16-inch- minimum diameter, stainless steel, threaded rod.

FINISHES

Fixtures: Manufacturers' standard, unless otherwise indicated.
Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
Metallic Finish: Corrosion resistant.

SOURCE QUALITY CONTROL

Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with drivers and lamps; certify results for electrical ratings and photometric data.

Factory test fixtures with drivers and lamps; certify results for electrical ratings and photometric data.

EXECUTION

INSTALLATION

Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

Suspended Fixture Support: As follows:
Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
Stem-Mounted, Single-Unit Fixtures: Suspend with two single-stem hangers or rod hangers, one at each end of fixture.

CONNECTIONS

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.

FIELD QUALITY CONTROL

Inspect each installed fixture for damage. Replace damaged fixtures and components.

Verify normal operation of each fixture after installation.

Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by owner.

Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

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.

Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

SECTION 16521 EXTERIOR LIGHTING

PART 1 - GENERAL

SUMMARY

This Section includes the following:
Exterior luminaires with LED lamps and drivers.
Lighting poles and standards, and other support structures for pole mounted exterior luminaries.
Accessories.

Related Sections include the following:
Division 03 Section "Structural Concrete" for concrete, reinforcement, and formwork required for concrete bases.

DEFINITIONS

CCT: Correlated color temperature.

CRI: Color-rendering index.

LED: Light Emitting Diode

L_{70}: Lumen depreciation to 70% of initial lumen output.

LER: Luminaire efficacy rating.

Luminaire: Complete lighting fixture, including driver housing if provided.

Pole: Luminaire support structure, including tower used for large area illumination.

SUBMITTALS

Product Data: For each luminaire, arranged in the order of lighting unit designation. Include data on features, accessories, finishes, and the following:
- Physical description of fixture, including dimensions and verification of indicated parameters.
- Luminaire dimensions, effective projected area, details of attaching luminaires, accessories, and installation and construction details.
- Luminaire materials.
- Complete catalog number designation as well as the following:
  - LED
    - CCT, CRI
    - Delivered lumen output
    - Driver
    - Drive current
    - LPW

Photometric data
Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
Anchor bolts for poles.

Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer

Field quality-control test reports.

Operation and Maintenance Data: For luminaires to include in maintenance manuals.

Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with IEEE C2, "National Electrical Safety Code."

Comply with NFPA 70.

DELIVERY, STORAGE, AND HANDLING

Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

WARRANTY

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace luminaires or components of luminaires and lamps that fail in materials or workmanship; corrode; or fade, stain, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
Warranty Period for Luminaires: Five years from date of Substantial Completion.
Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
Warranty Period for Color Retention: Five years from date of Substantial Completion.
Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than five years from date of Substantial Completion.
Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.

Special Warranty for LED drivers: Manufacturer's standard form in which driver manufacturer agrees to repair or replace driver that fail in materials or workmanship within specified warranty period.
Warranty Period for driver: Five years from date of Substantial Completion.

PRODUCTS

LUMINAIRES, GENERAL

Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction. Where LER is specified, test according to NEMA LE 5B.

Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

Metal Parts: Free of burrs and sharp corners and edges.

Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

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. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect driver when door opens.

Exposed Hardware Material: Stainless steel.

Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
White Surfaces: 85 percent.
Specular Surfaces: 83 percent.
Diffusing Specular Surfaces: 75 percent.

Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and drivers. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

For all luminaires provide the product specified in the lighting schedule or an equal product that meets the performance requirements listed within the specifications. Equals are subject to design team's acceptance.

Equal shall have the same aesthetic qualities and appearance as the specified luminaire including, but not limited to, shape, dimensions, mounting, and finish.

LED luminaires:

- Shall have the same delivered Lumen output within a 5% variation of the specified luminaire.
- Lumen data must be per IES LM-79 and 80.
- Lumen data must be based on equal drive current to specified fixture.
- Lumen data must be calculated at the same CCT as specified luminaire.
- Shall have the same efficacy within a 5% variation of the specified luminaire.
- Shall have the same input wattage within a 5% variation of the specified luminaire.

Provide photometric calculations for equals for typical areas upon request.

- Include in provided calculations LLF utilized.
- LLF for LED: .72 LLF.

Equals shall have the same electrical components as the specified luminaire including but not limited to the following:

- Lamping including number, type and layout within fixture (staggered or not).
- Distribution.
- Voltage.
- Driver shall be of the same type as listed in the schedule including drive current.

LED LUMINAIRES

Maintain color consistency and light intensity across multiple fixtures of the same designation and those with the same family with characteristics according to ANSI C78.377-2008 as a minimum.

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.

LED LIGHT SOURCES (LED PACKAGES, ARAYS OR MODULES)

Minimum Color Rendering Index of 70.

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.

Efficacy: 50 Lumens per watt unless otherwise indicated.

L_{70}: 50,000 hours minimum.

CCT: 4000-4100K.

LED POWER SUPPLY

Performance Requirements:

- Operate LED's within the current limit specifications for the LED manufacturer.
- Operate at 60Hz input source and have input power factor above 90% and a minimum efficiency of 70% at full rated load of the driver.
- Provide short circuit and overload protection.
- Provide dual level high low driver

Regulatory Requirements:
Contain no PCB’s (polychlorinated biphenyl).
Comply with IEEE C.62.41-1991, Class A operation.
Be UL 1310/8750 recognized when used in conjunction with a UL listed luminaire.

FACTORY FINISHES

Factory-Painted Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
Interior Surfaces: Apply one coat of bituminous paint on interior of pole, or otherwise treat to prevent corrosion.
Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
Color: As selected by engineer from manufacturer's full range.

Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

Structural Characteristics: Comply with AASHTO LTS-4-M.
Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
Materials: Shall not cause galvanic action at contact points.
Anchor Bolts, Leveling Hex Nuts, Flat Washers, Lock Washers, and Bolt Caps: Hot-dip galvanized after fabrication unless otherwise indicated.
Anchor-Bolt Template: Plywood or steel.

Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Structural Concrete."

Provide 3/4" X 10'-0" ground rods in the pole foundation so that the ground rod projects 3" up into center of pole base.

ALUMINUM POLES

Poles: Round, seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall. Aluminum with natural anodized finish.

Height: 35 feet.

Base: Breakaway, transformer type.

Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 16060 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

Tapered oval cross section, with straight tubular end section to accommodate luminaire.

Finish: Same as luminaire.

Accessories: Bussmann Type HEX double-pole in-line fuse holder for KTK type fuses, and Polaris wire connectors.

EXECUTION

LUMINAIRE INSTALLATION

Install lamps in each luminaire.

Luminaire Attachment: Fasten to indicated structural supports.

Adjust luminaires that require field adjustment or aiming.

POLE INSTALLATION

Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings.

Fire Hydrants and Storm Drainage Piping: 60 inches.
Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
Trees: 15 feet from tree trunk.

Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Structural Concrete."

Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
Install poles plumb. Install double nuts (one nut below and one nut above pole base plate) to adjust plumb.
Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
Install base covers unless otherwise indicated.
Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
The exposed surface area of the foundation shall have the forms removed and the concrete rubbed out to a smooth finish.

Raise and set poles using web fabric slings (not chain or cable).

CORROSION PREVENTION

Steel Conduits: Comply with Division 16 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

GROUNDING

Ground metal poles and support structures according to Division 16 Section "Grounding and Bonding for Electrical Systems."
Install grounding electrode for each pole unless otherwise indicated.
Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

CONNECTIONS

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.

FIELD QUALITY CONTROL

Inspect each installed fixture for damage. Operate each luminaire after installation and connection. Inspect for improper connections and operation. Replace damaged fixtures and components.

Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
Verify operation of photoelectric controls.

Illumination Tests:

Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
IESNA LM-64, "Photometric Measurements of Parking Areas."

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.

CLEANING

Clean photometric control surfaces as recommended by manufacturer.
Clean finishes and touch up damage.

23. Salt Storage Shed, Item SPV.0105.07.

A Description
The work under this item consists of designing, furnishing, and installing a complete salt storage shed structure and all associated items described herein. All items needed to construct the salt storage shed are included in the lump sum bid item, unless otherwise noted herein. Complete this work according to the plans, the special provisions as hereinafter provided, and the applicable sections of the standard spec. If there is a conflict in the requirements of this special provision and the standard spec, the stricter standard shall apply.

B (Vacant)

C (Vacant)

D Measurement
The department will measure Salt Storage Shed by the lump sum completed according to the contract and accepted, as a single complete lump sum unit of work.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.07	Salt Storage Shed	LS

Payment is full compensation for furnishing complete structural and architectural design and detailing of the salt storage shed and furnishing all materials and equipment, and for supplying all labor, tools, equipment, and incidentals necessary to construct the concrete foundation and walls, roof, and all other accessory items specified herein, including but not limited to, miscellaneous metals, pipe bollards, concrete stoops, doors, siding, exhaust fans, lighting, electrical, and other accessories; and construction staking for the structure; for obtaining necessary permits, for performing all required testing, and for furnishing manufacturer's warranties.

Site work including clearing, excavation, backfill, asphaltic pavement, and base course (including asphaltic pavement inside the building) and all other site related items will be paid for separately.

PART 1 – GENERAL

1.01 Description

Provide design and construction for a permanent pre-engineered building, weather tight, and suitable for the bulk storage of salt. The building design shall meet or exceed the performance, dimensional criteria, and other requirements of this specification.

1.02 Quality Assurance

Provide materials designed for use in a corrosive environment. Contractor is responsible for all products, components, accessories, and methods used in constructing the building.

The minimum printed code standard requirements for material quality, fabrication, and installation procedures shall be met or exceeded, for applicable methods employed in the building design.

1.03 Submittals

Furnish the following information as proof of conformity to design and performance criteria requirements of this specification. The information (for both submittal phases, below) shall be stamped with the registration seal of an Architect or a professional engineer, licensed in the state of Wisconsin and bearing the original stamp and signature of such architect or professional engineer.

A. Furnish a complete set of properly certified design drawings, indicating in detail all features of the proposed building.

B. Include the following information at a minimum in the building submittal:
   1. Complete design calculations for building and foundation work.
   2. For prefabricated structures: original working drawings, or copies of complete fabrication and erection drawings, material lists, and detailed erection instructions.
   3. Foundation work: detailed drawings for preparation and construction.

C. Product Data: For each type of building component

D. Shop Drawings as follows (this list is a minimum listing and does not limit the shop drawings to be provided).
   1. Concrete Foundations
   2. Steel Reinforcement
   3. Metal Plates and Fasteners
   4. Wood Products

5. Roofing System
6. Flashings
7. Doors and Frames
8. Electrical and Lighting
9. Ventilation Equipment
10. Site Work
11. Accessories

E. Provide Operation and Maintenance Manuals for all equipment installed in the building including but not limited to: overhead doors and operators, exhaust fans, and electrical systems.

1.04 Code Compliance

Design and build the structure in conformance with all applicable codes. Consult the state of Wisconsin website for information on all adopted codes and other ordinances. The governing building code is the Wisconsin Commercial Building Code, which adopted by reference the 2009 International Building Code and companion codes. Complete design plan approval from the Wisconsin Department of Safety and Professional Services (WDSPS) is required prior to commencing construction. Complete the Application for Review (Form SBD-118), submitting properly stamped and signed drawings, calculations and any other required documentation to WDSPS for plan review. Instructions and submittal requirements are provided on the WDSPS website. The final building review submittal will be classified as a "Miscellaneous Structural Review" submittal. Pay all fees associated with the WDSPS plan submittal and resubmittals as required by WDSPS. All parts of the design will require a scheduled review and approval prior to any construction. The scheduled review process may take approximately 8 weeks from the time the application is submitted. Plan approval will require a variance allowing for a single exit door from the structure as shown on the plans. The contractor is responsible for obtaining this variance. Additionally, the contractor is responsible for the complete design and all WDSPS approvals and associated fee.

PART 2 – RELATED WORK

This section identifies work that is not included in the Salt Storage Shed bid item and is paid separately as part of other contract bid items.

2.01 Earthwork and Foundation Excavation

Perform excavation for building footings according to the WisDOT standard specifications and recommendations in the geotechnical report available from the department. Note that over-excavation and backfill may be required in some areas of the building footprint. After completing the excavation for footings, the department's Regional Soils engineer will review the site to determine if the subgrade is suitable for the intended loads. Allow the Regional Soils engineer two working days to perform the review.

2.02 Building Floor

Coordinate Hot Mix Asphalt pavement and base installation with the building construction.

2.03 Final Grading and Restoration

Perform all work related to final grading and site restoration according to the site plans and applicable specifications.

PART 3 – DESIGN CRITERIA & PRODUCTS

3.01 Building Design and Performance Criteria

A. General

Design the building to provide a gambrel style roof design as provided by Advanced Storage Technology, Inc., Wheeler, Inc., Bulk Storage, Inc. or equivalent that satisfies the requirements herein.

B. Dimensional Requirements for Building

Width: 80-feet (inside)
Length: 224-feet (inside)
Vertical Side Wall Height: 12'-feet above finished floor
Overall Height: Not to exceed 45-feet above finished grade

C. Building Structural Requirements

Provide a rigid, self-supporting structure comprised of standard building framing components, or an approved building system of integrated structural components, complete with necessary foundations which are designed to securely and permanently support roof and wall construction. Design building to meet or exceed the following minimum structural design criteria:

1. Ground Snow Load: 30 PSF
2. Lateral Wind Load: 90 mph, Exposure C
3. Net Allowable Soil Bearing Pressure: 4,000 PSF
4. Seismic Design Category: A

D. Building Products

Meet the minimum required standards for the products listed below.

1. Concrete:

   Provide concrete with a minimum compressive strength of 4,000 psi according to standard spec 501 of the WisDOT standard specifications. Provide reinforcing steel according to standard spec 505 of the WisDOT standard specifications. Provide epoxy coating on wall reinforcement. Footing reinforcement may be uncoated. Provide QMP for class III ancillary concrete as specified in standard spec 716.
2. Preservative Treated Wood:
   a. Comply with applicable American Wood Preserver's Association (SWPA) requirements.
   b. Kiln dry all lumber to a maximum moisture content of 19 percent before treatment.

c. Treat all above-ground lumber exposed to weather, or directly in contact with salt or concrete, with water-borne preservatives for above-ground use, complying with AWPA-LP-2 (CCA .40).
d. All wood components with a nominal thickness of 2-inches or less shall have a moisture content not to exceed 19 percent when installed.

3. Metal Plates and Fasteners:
   a. Design metal plates and fasteners used in the building (truss bearing plates, shear plates, truss gusset plates, joist hangers, nails, bolts, nuts, washers, screws, etc.) that are in direct contact with salt, or that are exposed to an atmosphere containing salt, to resist corrosion due to such contact or exposure.
   b. Provide products meeting the following specific requirements (if used in the building):
      Truss bearing plates, bolts, and washers: stainless steel
      Truss gusset plates: galvanized steel, epoxy-coated
      Joist hangers: triple-zinc coated
      Nails attached to CCA or CDX lumber: galvanized

E. Interior Space
   1. Provide unobstructed interior space to allow filling of the storage area to full capacity, and to allow unimpeded loading of truck-spreader vehicles with front-end loading equipment. Provide the entire interior floor area free of columns or roof supports of any type.

   2. Minimum Center Clearance Room: Provide a 34’-9” clear height at the center of the building width. Maintain this clear height for a minimum width of 20 feet, centered on the entranceway and running the length of the structure.

F. Concrete Wall Construction
   1. Design the concrete wall to resist the weight (i.e. forces) of salt assuming the following loading conditions:
      a. Salt will be stored to a contained height of twelve feet (12’) against the concrete wall.
      b. The salt will further slope upwards and away from the concrete wall toward a peak or ridge in the center of the building at an anticipated 32-degree angle of repose.
      c. The resulting horizontal force created against the concrete wall is anticipated to be 0.72 times the weight of the salt.
   2. Design the concrete wall to resist a salt load of 100 pounds per cubic foot, to resist a horizontal impact load of 250 pounds.
   3. Materials:
      a. Provide epoxy coated reinforcement bars in any concrete used above grade.
      b. Use forms with accessories as required to achieve properly formed and cured concrete walls with minimal number of joints and a clean surface finish on interior and exterior faces of concrete walls.

c. Apply protective surface treatment coating to the interior surfaces of the concrete wall according to standard spec 502.3.13.2. Furnish a product from the department's approved products list for Concrete Protective Surface Treatment.

4. Execution:
   a. Provide concrete according to standard spec 501.
   b. Follow the requirements in standard spec 501 for cold weather concreting as applicable and the requirements in standard spec 501 for hot and cold weather concreting as applicable.
   c. Unless adequately protected, do not place concrete during rain, sleet, or snow.
   d. Damaged concrete, as determined by the engineer, must be removed and replaced at the contractor's expense.

G. Upper End Wall Construction

Provide an end wall system, above the level of the concrete wall with board and batten style vinyl siding, applied over APA rated 5/8" CDX plywood sheathing. Design end wall to resist applicable wind loading and to support the doors and other attachments as required.

H. Vinyl Siding

1. Provide vinyl siding product meeting the following reference standards:
   ASTM D3679-Rigid Poly Vinyl Chloride (PVC) Siding
   ASTM D4226-Impact Resistance of Rigid Poly Vinyl Chloride Building Products
2. Submittals – Provide product data and selection samples to engineer
3. Warranty – Furnish siding and accessories carrying a manufacturer warranty against defects for a minimum of 50 years. Warranty shall include materials and labor and shall not be prorated.
4. Style – Provide 7-inch board and batten style vertical siding.
5. Properties:
   a. Tensile Strength (psi): 6600.
   b. Deflection Temperature (^{o}F) @ 264 psi: 165.
   c. Modulus of Elasticity (psi): 435,000
   d. Izod Impact (ft-lbs./in Notch): 4.0
   e. Hardness (Durometer Shore D): 78.0.
   f. Coefficient of Expansion (in./in./^{o}F): 3.2×10^{-5}.
   g. Chemical Resistance Properties: Excellent.
   h. Flame Spread Index: 20.0.
   i. Smoke Density Developed: 405.
6. Provide siding with minimum thickness of 0.046 inches constructed of 100% polyvinyl chloride with embossed woodgrain pattern.
7. Accessories – Provide 6-inch wide trim piece around border and around openings.
8. Color – Provide color samples to the engineer for final color selection.
9. Fasteners – Provide corrosion-resistant galvanized steel nails.

10. Installation – Install siding according to manufacturer's instructions. Provide gaps for expansion as recommended by manufacturer.
11. Protection – Maintain surfaces in clean condition. Replace damaged components.
12. Paint unfinished exterior trim with two (2) coats of alkyd primer and two (2) coats of acrylic latex paint, according to manufacturer's recommendations.

I. Doors

1. Overhead Coiling Door – Provide one unobstructed rectangular entrance opening, nominal dimensions to be 32-feet high by 20-feet wide.
    a. Provide an exterior mounted overhead coiling door with electric motor operation and all operating hardware, controls, and supports. Door is to include a chain hoist to provide capability for manual operation of the door.
    b. Design door for 20 pounds per square foot minimum wind load. Supply and install all head and jamb framing and blocking as required by door manufacturer.
    c. Construct door of 20 gauge steel slats galvanized according to ASTM A653.
    d. Bottom Bar – Provide bottom bar comprised of two galvanized steel angles bolted back-to-back with minimum of 1/8 inch thickness.
    e. Guides – Provide guides consisting of three galvanized structural steel angles with minimum thickness of 3/16 inch. Provide full height PVC weather seals contacting both interior and exterior surface of the curtain to minimize air flow.
    f. Counterbalance – Provide counterbalance torsion springs housed in a steel pipe barrel supporting the curtain with a deflection limited to 0.03 inches per foot of width. Design counterbalance for a minimum of 20,000 cycles.
    g. Enclosure – Provide hood designed for exterior mount with minimum 24 gauge galvanized steel finished to match door. Provide internal baffle to inhibit air infiltration.
    h. Electric Door Operator – Provide 480 volt, three-phase continuous duty motor with instant reverse and automatic reset thermal overload. Provide motor size as recommended by overhead door manufacturer. Motor shall be totally enclosed non-ventilated type. Provide operator with a brake that is spring-set and solenoid released and able to stop and hold curtain in any position. Provide PVC pushbutton control station (open/close/stop) rated NEMA 4X and radio transmitter/receiver unit with remote controller. Provide electric sensing edge to stop and reverse the door upon contacting an object while closing. Control system shall use a heavy-duty reversing contactor, electrically and mechanically interlocked. System shall accommodate connection of sensing edge and control stations. Electrical controls and devices shall be rated NEMA 7 and be suitable for corrosive environment. All devices and controls shall

be provided by door manufacturer and be powered from control panel transformer provided with the unit.

i. Finished – Provide UV-resistant powder coated white finish on curtain and hood. Provide factory applied rust inhibitive primer compatible with field paint to all components not powder coated.

j. Installation – Provide all required casing materials. Install door according to manufacturer's instructions and standards. Upon completion of installation, adjust operating controls, and lubricate door according to manufacturer's recommendations.

2. Fiberglass Service Door – Provide 3'-0" x 7'-0" fiberglass door according to the following specifications.

a. Materials – Construct door from corrosion-resistant resign with light-stabilizing additives and a minimum glass fiber to resin ratio of 40 percent. Anchor door frame with stainless steel anchors and fasteners.

b. Construction – Minimum door thickness is 1 3/4 inches. Construct with polyurethane foam core and FRP face sheets molded in one continuous piece. Provide minimum 15 mil gel-coated surface. Provide 1 1/2 inch square stiles and rails from pultruded fiberglass tubes. Provide polymer blocking for all hardware reinforcing.

c. Frame – Provide one-piece pultruded FRP frame with minimum 1/4- inch wall thickness. Provide jamb to head joints mitered and reinforced with FRP clips and stainless steel fasteners. Provide 15 mil gel coat finish to match door.

d. Frame Profile – 5 3/4 inches deep, 2 inch wide face, with 5/8 inch high stop. Provide 4-inch head frame.

e. Hardware – Provide mortises and reinforced polymer blocking for all hardware. Provide locksets and latchsets with stainless steel finish. Acceptable products include Schlage L Series, or equal to match Dane County master key system. Provide removable core brass 6-pin or 7-pin cylinders for all locksets and latchsets.

f. Hinges – Provide stainless steel Stanley FBB 191, Hager BB 1191, or equal butt hinges with full mortise, ball bearing, nonferrous, nonrising loose pin and flat bottom tip. Provide three hinges per door.

g. Provide stainless steel kickplates and weather stripping. Kick plates shall be Rockwood, or equal, 6 inches high. Kick plate width shall be 2 inches less than door width. Doors shall be weatherstripped with Reese DS75, National Guard Products, Inc. 156, or equal, weatherstripping. Provide Reese 323C, Pemko 315AN, or equal, sweeps; and Reese S425A, Pemko 171A, or equal, thresholds.

h. Keying – Key Door to match Waukesha County Highway Operations Department master key. Provide five keys per lock.

J. Pipe Bollards

Furnish and install two pipe bollards, minimum six inches (6") in diameter and eight feet (8') in length, consisting of Schedule 80 galvanized steel structural pipe, filled with concrete. Furnish grade A, A-FA, A-S, A-T, A-IS, or A-IP

concrete within the pipe bollard according to standard spec 501. Form concrete crown at top of bollard. Embed pipes in concrete footings, and paint white with a 3-coat epoxy paint system (primer plus two finish coats). Paint the entire length of the pipe.

K. Roofing System (General)

1. Type: Prefabricated or site-built, complete with all necessary accessories, fastening devices, trim, and flashings.
2. Drainage: Positive slope; no standing water.
3. Strength: Comply with structural criteria specified in Section 3.01.C.
4. Wind Resistance: 60 psf (uplift).
5. Compatibility: All materials to be physically and chemically compatible with each other and with adjacent building components.
6. Products:
    a. Metal Roofing – 29 gauge (or heavier) galvanized coated steel panels, with color matched fasteners, carrying a manufacturer's warranty of at least 30 years for labor and materials. Roofing color to be selected by the engineer. Acceptable products are GrandRib 3 Plus by Fabral with Enduracote finish, Stormproof by MBCI with Signature 200 paint system, Max Rib by McElroy with siliconized polyester paint system, or equivalent.
    b. Roofing Underlayment – Roofing base shall be 30-pound synthetic underlayment such as Titanium, GAF, or equivalent underlayment product as recommended by metal roofing manufacturer.
    c. Sheathing – APA rated, minimum 5/8-inch thick nominal, CDX plywood roof sheathing. Metal roofing attached directly to trusses will not be accepted.
    d. Sheathing Clips – Provide nylon H-Clips between roof sheathing.
    e. Trim – Provide metal rake trim at all edges and slope changes.
    f. Roof Ridge Vents – Provide suitable openings located at or near the highest point of the roof to provide a minimum ratio of 1 square inch of free air for each 55 square feet of building floor area. Color to match adjacent roofing materials.

L. Fire Extinguishers

Provide two dry-chemical-type, multi-purpose 10-pound-capacity fire extinguishers at locations shown on plans. Fire extinguishers shall be UL-approved for Class A, Class B, and Class C fires. Provide units conforming to NFPA 10 requirements for portable fire extinguishers. Install according to manufacturer's instructions. Place extinguishers in brackets mounted so the handle is at 48 inches above the finished floor.

M. Concrete Stoop and Approach Slab

Provide concrete stoop and approach slab as shown on the plans.

3.02 Installation and Erection

A. Provide all required foundations and supports at the required elevations on properly prepared subgrade, as required for the erection of the building.

B. Provide foundation size and depth as required to resist frost action.

C. Provide the complete building and required appurtenances conforming to the performance requirements of these specifications.

3.03 Mechanical and Electrical

Provide mechanical and electrical work according to the plans.

PART 4 – TECHNICAL SPECIFICATIONS

Technical specifications that apply to the Salt Storage Shed item include any and all applicable technical specifications contained in the Brining Building General Construction, Brining Building Plumbing, Brining Building Heating and Ventilation, and Brining Building Electrical items.

24. Water Service, Item SPV.0105.08.

A Description

This special provision describes the work by the contractor as required to provide a water service from the existing Municipal water main to the proposed Brine Building, of the indicated size, according to the plans and as hereinafter provided.

B Materials

Water lateral shall be PVC DR-14 C-900 pipe of the indicated diameter, conforming to the Waukesha Water Utility specifications. The Wisconsin Administrative Code and the Standard Specifications for Sewer and Water Construction in Wisconsin are incorporated by reference.

C Construction

Contractor shall make all arrangements to provide and install the water service as shown on the plans, and coordinate work with the Waukesha Water Utility, City Building Inspection, and their specifications.

The Waukesha Water Utility shall provide and install the tapping sleeve and gate valve with box. The contractor is to provide trench, shield, and means for lowering tapping machine. The Waukesha Water Utility shall provide and install the 3" water meter. The Waukesha Water Utility personnel will operate all water main valves. Water service shall be tested after installation. Contractor to coordinate with Waukesha water utility to inspect and approve installation.

D Measurement

The department will measure Water Service by the lump sum, acceptably completed, in place as a single complete unit of work from the water main through and including the water meter assembly.

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	Water Service	LS

Payment is full compensation for furnishing and installing: mobilization; temporary sheathing, shoring, and bracing; dewatering; connection to existing water main pipe; a buried water service and all appurtenances including the water meter; all hauling, placing, and compacting all materials; all excavation, bedding, backfilling and disposing of excess material; all material not permanently incorporated in the work; and for all labor, material, equipment, tools, and incidentals necessary to complete the work as specified herein and as shown on the plans.

25. Electrical Service, Item SPV.0105.09.

A Description
This special provision describes the work by the contractor as required to provide electrical service feeder extended from the existing highway maintenance building to the Brining Building and Salt Storage Shed, according to the plans and as hereinafter provided. Electrical service shall include underground three-phase service to the new Brining Building and Salt Storage Shed; wire and terminations at the service panel.

Site lighting is included under other bid items.

B (Vacant)

C Construction
Contractor shall perform all work.

Contractor will provide wire; and all terminations at tie-in to existing service in existing building and at the new service panel.

The allowance for electric service work as specified under special provision "Utilities" shall be incorporated into the bid price for this bid item.

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 lump sum, acceptably completed, in place as a single complete unit of work from the existing highway maintenance building to the new Brining Building and Salt Storage Shed.

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	Electrical Service	LS

Payment is full compensation for providing underground three phase electric service from existing source to new Brining Building and Salt Storage Shed, 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.

26. Site Lighting, Item SPV.0105.10.

A Description

This special provision describes furnishing and installing bases, posts, fixtures, conduit, and grounding rods for site lighting units at the locations shown on the plans and according to Standard Specification 659, the plans, and as hereinafter provided.

B Materials

Furnish products specified on the electrical site plans. See electrical site lan for IES distribution. See lighting specification of the Building Specifications for further requirements.

C Construction

Adhere to the Standard Specifications and follow all manufacturer's recommendations.

D Measurement

The department will measure Site Lighting by the lump sum completed according to the contract and accepted, as a single complete unit of work.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.10	Site Lighting	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.

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:

104.10.1 General

Replace paragraph one with the following effective with the December 2017 letting:

(1) Subsection 104.10 specifies a 2-step process for contractors to follow in submitting a cost reduction incentive (CRI) for modifying the contract in order to reduce direct construction costs computed at contract bid prices. The initial submittal is referred to as a CRI concept and the second submittal is a CRI proposal. The contractor and the department will equally share all savings generated to the contract due to a CRI as specified in 104.10.4.2(1). The department encourages the contractor to submit CRI concepts.

104.10.4.2 Payment for the CRI Work

Replace paragraph one with the following effective with the December 2017 letting:

(1) The department will pay for completed CRI work as specified for progress payments under 109.6. The department will pay for CRI's under the Cost Reduction Incentive administrative item. When all CRI costs are determined, the department will execute a contract change order that does the following:

1. Adjusts the contract time, interim completion dates, or both.
2. Pays the contractor for the unpaid balance of the CRI work.
3. Pays the contractor 50 percent of the net savings resulting from the CRI, calculated as follows:

NS = CW - CRW - CC - DC

Where:

NS = Net Savings

CW = The cost of the work required by the original contract that is revised by the CRI. CW is computed at contract bid prices if applicable.[1]

CRW = The cost of the revised work, computed at contract bid prices if applicable.[1]

CC = The contractor's cost of developing the CRI proposal.

DC = The department's cost for investigating, evaluating, and implementing the CRI proposal.

[1] The department may adjust contract bid prices that, in the engineer's judgement, do not represent the fair value of the work deleted or proposed.

108.11 Liquidated Damages

Replace paragraphs two and three with the following effective with the December 2017 letting:

(2) This deducted sum is not a penalty but is a fixed, agreed, liquidated damage due the department from the contractor for the added cost of engineering and supervision resulting from the contractor's failure to complete the work within the contract time.

(3) Unless enhanced in the special provisions, the department will assess the following daily liquidated damages

LIQUIDATED DAMAGES

ORIGINAL CONTRACT AMOUNT		DAILY CHARGE	
FROM MORE THAN	TO AND INCLUDING	CALENDAR DAY	WORKING DAY
$0	$250,000	$850	$1700
$250,000	$500,000	$815	$1630
$500,000	$1,000,000	$1250	$2500
$1,000,000	$2,000,000	$1540	$3080
$2,000,000	___	$2070	$4140

203.3.2.2 Removal Operations

Replace the entire text with the following effective with the December 2017 letting:

203.3.2.2.1 General

(1) Except as specified below for closing culverts, remove the entire top slab of box culverts and the entire superstructure of other culverts and bridges designated for removal. Completely remove existing piles, cribs, or other timber construction within the limits of new embankments, or remove these structures to an elevation at least 2 feet below finished ground line. Remove sidewalls or substructure units in water to an elevation no higher than the elevation of the natural stream or lake bed, or, if grading the channel is required under the contract or the plans, to the proposed finished grade of the stream or lake bed. Remove sidewalls or substructure units not in water down to at least 2 feet below natural or finished ground line.

(2) If extending or incorporating existing culverts and bridges in the new work, remove only those parts of the existing structure as necessary to provide a proper connection to the new work. Saw, chip, or trim the connecting edges to the required lines and grades without weakening or damaging the remaining part of the structure. During concrete removal, do not damage reinforcing bars left in place as dowels or ties incorporated into the new work.

(3) Remove pipe culverts designated for salvage in a way that prevents damage to the culverts.

(4) Dismantle steel structures or parts of steel structures designated for salvage in a way that avoids damage to the members. If the contract specifies removing the structure in a way that leaves it in a condition suitable for re-erection, matchmark members with durable white paint before dismantling. Mark pins, bolts, nuts, loose plates, etc., similarly to indicate their proper location. Paint pins, bolts, pinholes, and machined surfaces with a department-approved rust preventative. Securely wire loose parts to adjacent members, or label and pack them in boxes.

(5) Remove timber structures or parts of timber structures designated for salvage in a way that prevents damage to the members.

(6) If the engineer approves, the contractor may temporarily use materials designated for salvage in falsework used to construct new work. Do not damage or reduce the value of those materials through temporary use.

203.3.2.2.2 Deck Removal

(1) Protect the work as specified in 107.14 during deck removal. Minimize debris falling onto water surfaces and wetlands as the contract specifies in 107.18 or in the special provisions. Also, minimize debris falling on the ground and roadway.

(2) Do not damage existing bar steel reinforcement, girders, or other components that will be incorporated in new work. Remove decks on prestressed concrete girders using a hydraulic shear or other engineer-approved equipment. Thoroughly clean, realign, and retie reinforcement as necessary.

(3) After deck removal is complete, notify the engineer to request a damage survey. Point out damage to the engineer. Allow one business day for the engineer to complete the damage survey. If damage is identified, the department will determine if repairs or girder restoration will be allowed.

(4) If the department allows girder restoration, have a professional engineer registered in the State of Wisconsin analyze the effect of the damage to the bridge, make recommendations, and prepare signed and sealed computations and structural details required to restore girders to their previous structural capacity. Submit the restoration proposal, including analysis and structural details, to the department and design engineer of record. The department will accept or reject the restoration proposal within 3 business days. Do not begin restoration work until the department allows in writing.

(5) The engineer will not extend contract time to assess or remediate contractor caused damage.

203.5.1 General

Replace paragraph two with the following effective with the December 2017 letting:

(2) Payment is full compensation for breaking down and removing; costs associated with contractor-caused damage; required salvaging, storing, and disposing of materials; and, unless the contract specifies granular backfill, for backfilling.

415.2.3 Expansion Joint Filler

Replace paragraph one with the following effective with the December 2017 letting:

(1) Furnish expansion joint filler conforming to AASHTO M153, AASHTO M213, or ASTM D8139 in lengths equal to the pavement lane width and of the thickness and height the plans show. Where dowel bars are required, use filler with factory-punched holes at the dowel bar locations and with a diameter not greater than 1/8 inch larger than the nominal dowel bar diameter.

415.3.20 Filling Joints

Replace paragraph two with the following effective with the December 2017 letting:

(2) Clean joints of laitance, curing compound, and other contaminants before filling. Saw construction joints at least 3/4 inches deep before filling. Sawing is not required for tooled joints in curb and gutter. Sandblast or waterblast exposed joint faces using multiple passes as required to clean joints surfaces of material that might prevent bonding. Blow clean and dry with oil-free compressed air immediately before filling.

415.5.1 General

Replace paragraph six with the following effective with the December 2017 letting:

(6) Payment for Concrete Pavement Joint Filling is full compensation for filling concrete pavement joints; filling adjacent curb and gutter joints; and for sawing.

440.3.4.2 Contractor Testing

Replace paragraph two with the following effective with the December 2017 letting:

(2) Coordinate with the engineer at least 24 hours before making profile runs for acceptance unless the engineer approves otherwise. The department may require testing to accommodate staged construction or if corrective action is required.

455.5.3 Tack Coat

Replace paragraph two with the following effective with the December 2017 letting:

(2) The department will adjust pay for Tack Coat, under the Nonconforming Tack Coat administrative item, for nonconforming material the engineer allows to remain in place at a maximum of 75 percent of the contract unit price.

460.2.7 HMA Mixture Design

Replace paragraph one with the following effective with the December 2017 letting:

(1) For each HMA mixture type used under the contract, develop and submit an asphaltic mixture design according to CMM 8-66 and conforming to the requirements of table 460-1 and table 460-2. The values listed are design limits; production values may exceed those limits. The department will review mixture designs and report the results of that review to the designer according to CMM 8-66.

TABLE 460-2 MIXTURE REQUIREMENTS

Mixture type	LT	MT	HT	SMA
ESALs x 10^6 (20 yr design life)	<2.0	2 - <8	>8	___
LA Wear (AASHTO T96)				
100 revolutions(max % loss)	13	13	13	13
500 revolutions(max % loss)	50	45	45	40
Soundness (AASHTO T104) (sodium sulfate, max % loss)	12	12	12	12
Freeze/Thaw (AASHTO T103) (specified counties, max % loss)	18	18	18	18
Fractured Faces (ASTM D5821) (one face/2 face, % by count)	65/___	75 / 60	98 / 90	100/90
Flat & Elongated (ASTM D4791) (max %, by weight)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	20 (3:1 ratio)
Fine Aggregate Angularity (AASHTO T304, method A, min)	40	43	45	45
Sand Equivalency (AASHTO T176, min)	40	40	45	50
Gyratory Compaction				
Gyrations for N_{ini}	6	7	8	8
Gyrations for N_{des}	40	75	100	65
Gyrations for N_{max}	60	115	160	160
Air Voids, $\%V_a$ ($\%G_{mm}$ N_{des})	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)
% G_{mm} N_{ini}	<= 91.5[1]	<= 89.0[1]	<= 89.0	___
% G_{mm} N_{max}	<= 98.0	<= 98.0	<= 98.0	___
Dust to Binder Ratio[2] (% passing 0.075/P_{be})	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2	1.2 - 2.0
Voids filled with Binder (VFB or VFA, %)	68 - 80[4] [5]	65 - 75[3] [5]	65 - 75[3] [5]	70 - 80
Tensile Strength Ratio (TSR) (AASHTO T283)[6] [7]				
no antistripping additive	0.75 min	0.75 min	0.75 min	0.75 min
with antistripping additive	0.80 min	0.80 min	0.80 min	0.80 min
Draindown (AASHTO T305) (%)	___	___	___	0.30

[1] The percent maximum density at initial compaction is only a guideline.

[2] For a gradation that passes below the boundaries of the caution zone (ref. AASHTO M323), the dust to binder ratio limits are 0.6 - 1.6.

[3] For No. 5 (9.5mm) and No. 4 (12.5 mm) nominal maximum size mixtures, the specified VFB range is 70 - 76 percent.

[4] For No. 2 (25.0mm) nominal maximum size mixes, the specified VFB lower limit is 67 percent.

[5] For No. 1 (37.5mm) nominal maximum size mixes, the specified VFB lower limit is 67 percent.

[6] WisDOT eliminates freeze-thaw conditioning cycles from the TSR test procedure.

[7] Run TSR at asphalt content corresponding to 3.0% air void regressed design using distilled water for testing.

460.2.8.2.1.3.1 Contracts with 5000 Tons of Mixture or Greater

Replace paragraph six with the following:

(6) Conduct TSR tests during mixture production according to CMM 8-36.6.14. Test each full 50,000 ton production increment, or fraction of an increment, after the first 5000 tons of production. Perform required increment testing in the first week of production of that increment. If production TSR values are below the limit specified in CMM 8-36.6.14, notify the engineer. The engineer and contractor will jointly determine a corrective action.

502.2.7 Preformed Joint Filler

Replace paragraph one with the following effective with the December 2017 letting:

(1) Use preformed joint filler conforming to AASHTO M153, AASHTO M213, or ASTM D8139.

502.3.7.8 Floors

Replace paragraph fourteen with the following effective with the December 2017 letting:

(14) Unless specified otherwise, transversely tine finish the floors of structures with approach pavements designed for speeds of 40 mph or greater as specified in 415.3.8.3, except make the tining 1/8 inch in depth and do not perform tining within 12 inches of gutters. The contractor may apply a broom finish, described below, instead of the artificial turf drag finish required before tining. The contractor may perform tining manually, if it obtains a finish satisfactory to the engineer. Perform tining within 20 degrees of the centerline of bearing of the substructure units on bridge decks having skew angles of 20 degrees or greater.

505.2.6 Dowel Bars and Tie Bars

Replace the entire text with the following effective with the March 2018 letting:

505.2.6.1 General

(1) Furnish bars coated in a plant certified by the Concrete Reinforcing Steel Institute. For dowel bars and straight tie bars, there is no requirement for bend tests. Ensure that the bars are the specified diameter and length the plans show.

(2) The contractor need not coat or patch sawed ends, sheared ends, cut ends, ends left bare during the coating process, or ends with damaged coating.

(3) The contractor need not repair circumferential coating damage from shipping, handling, or installation, if the following conditions are met:

1. The damaged area is 1/4 inch square or smaller.
2. The total damaged area in any one-foot length does not exceed 2 percent of the circumferential area in that length.

(4) Repair areas of damaged circumferential coating larger than 1/4 inch square. Reject bars with total damage greater than 2 percent of the bar's circumferential area.

505.2.6.2 Dowel Bars

505.2.6.2.1 General

(1) Ensure that the bars are straight, round, smooth, and free from burrs or other deformations detrimental to the free movement of the bar in the concrete.

(2) Saw bars to the required length. For solid bars, the department will allow shearing if no damage occurs to the coating and shearing distortions do not exceed the following:

1. No distorted diameter is more than 0.04 inches greater than the true diameter.
2. No distortion extends more than 0.40 inches from the sheared end.

(3) Apply a surface treatment to loose dowels, or furnish manufacturer-treated bars in dowel bar baskets, capable of preventing bond between the epoxy-coated bars and the concrete. Apply field surface treatments when loading bars in the dowel bar magazine.

505.2.6.2.2 Solid Dowel Bars

(1) Furnish coated bars conforming to AASHTO M31 grade 40 or 60. Alternatively the contractor may furnish dowel bars conforming to AASHTO M227 grade 70-80. Coat with a thermosetting epoxy conforming to AASHTO M254, type B.

505.2.6.2.3 Tubular Dowel Bars

(1) Furnish welded steel tubular bars conforming to ASTM A513 fabricated from plain carbon steel with a minimum tensile yield strength of 60 ksi and sized as follows:

SOLID BAR SPECIFIED DIAMETER	MINIMUM REQUIRED OUTSIDE DIAMETER	MINIMUM BASE METAL WALL THICKNESS
1 1/4-inch	1 5/16 inches	0.120 inch
1 1/2-inch	1 5/8 inches	0.120 inch

(2) Cap bar ends to prevent intrusion of concrete or other materials. Ensure that tubing is galvanized on the exterior and interior according to ASTM A653 with a G40 zinc coating and apply 7-13 mils of epoxy to the galvanized exterior according to AASHTO M254, Type B.

505.2.6.2.4 High Performance Dowel Bars

(1) As an alternate the contractor may furnish high performance dowel bars from the department's APL.

505.2.6.3 Tie Bars

(1) Furnish coated bars conforming to AASHTO M31 grade 40 or 60. Coat tie bars as specified in 505.2.4 for coated high-strength steel reinforcement. Ensure that the tie bars are the shape the plans show.

(2) Repair, with compatible coating material, the bend location of field-straightened coated tie bars.

614.2.1 General

Add the following as paragraph ten effective with the December 2017 letting:

(10) Furnish guardrail reflectors from the department's APL.

614.3.2.1 Installing Posts

Add the following as paragraph five effective with the December 2017 letting:

(5) Provide post-mounted reflectors every 100 feet with one at the beginning and end of each run and a minimum of three reflectors per run.

614.5 Payment

Replace paragraph four with the following effective with the December 2017 letting:

(4) Payment for the Steel Thrie Beam, Steel Plate Beam Guard, Guardrail Stiffened, MGS Guardrail, Short Radius, and various transition bid items is full compensation for providing guardrail and transitions including post-mounted reflectors; for repairing damaged zinc coatings; and for excavating, backfilling, and disposing of surplus material.

641.2.9 Overhead Sign Supports

Replace paragraph three with the following effective with the December 2017 letting:

(3) Provide steel pole shafts, mast arms or trusses, and luminaire arms zinc coated according to ASTM A123. The contractor may provide either straight or tapered pole and arm shafts unless the plans specify otherwise. Provide bolts and other hardware conforming to 641.2.2.

642.2.2.1 General

Replace the entire text with the following effective with the December 2017 letting:

(1) Provide each field office with two rooms, separated by an interior door with a padlock. Ensure that each room has a separate exterior door and its own air conditioner. Locate the office where a quality internet connection can be achieved.

(2) Provide long distance telephone service via a land line for exclusive department use that has the following:

- Two programmable touch-tone phones, one of which is cordless. Ensure that phone operations will not interfere with other telecommunications equipment.
- Voice mail service or an answering machine.

(3) Provide high-speed internet service for exclusive department use via cable or DSL connection with a modem/router and capable of supporting cloud enabled file sharing, voice over internet protocol (VoIP), video conferencing, and web based applications. Ensure that system meets the following:

- Includes a wireless network for the field office.
- Can accommodate IPSec based VPN products.
- Has a bandwidth range as follows:

Field office with 1-5 staff:	A minimum connection speed of 5 Mbps download and 1 Mbps upload. If a cable or DSL option is not available the contractor may provide a personal hotspot using cell phone tethering or other device able to achieve the specified minimum speeds inside the field office.
Field office with 6 or more staff:	A minimum connection speed of 10 Mbps + 1/2 Mbps per user download and 5 Mbps upload.
Projects over 500 million dollars:	A minimum connection speed of 20 Mbps + 1/2 Mbps per user download and 10 Mbps upload. Coordinate network setup at the leased office with the WisDOT network team.

(4) Provide and maintain a Windows 7 and Windows 10 compliant multi-function device with copy, print, and scan capabilities that can accommodate both 8 1/2" x 11" and 11" x 17" paper. Replenish paper, toner cartridges, and other supplies before fully expended. Ensure that department staff can connect to the device either directly or through the field office wireless network.

(5) Equip with a drafting table with a drafter's stool. Except as specified in 642.2.2.4, provide 2 ergonomically correct office chairs in working condition with, at a minimum, the following:

1. Five-legged base with casters.
2. Seat adjustable from 15 to 22 inches from the floor with a seamless waterfall, rounded, front edge.
3. High backrest with no arms or adjustable arms.

643.3.1 General

Replace paragraph one with the following effective with the December 2017 letting:

(1) Provide and maintain traffic control devices located where the plans show or engineer directs to maintain a safe work zone throughout the contract duration. Relocate as required to accommodate changing work operations. When not in use, place devices away from traffic outside of paved and gravel shoulder surfaces. Where there is barrier on the shoulder, the contractor may place devices not in use on the shoulder as close as possible to the barrier and delineated with drums. Lay signs and supports flat on the grade with uprights oriented parallel to and downstream from traffic. Do not stack devices or equipment. Promptly remove temporary devices from within the project limits as follows:

- That will not be used within 14 consecutive calendar days.
- Within 5 business days of substantial completion unless the engineer allows otherwise.

645.2.2.2 Geotextile, Type SAS (Subgrade Aggregate Separation)

Replace paragraph one with the following effective with the December 2017 letting:

(1) Furnish fabric conforming to the following physical properties:

TEST	METHOD	VALUE[1]
Minimum grab tensile strength	ASTM D4632	170 lb
Minimum puncture strength	ASTM D6241	350 lb
Maximum apparent opening size	ASTM D4751	No. 70
Minimum permittivity	ASTM D4491	0.35 s^{-1}

[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

645.2.2.4 Geotextile, Type DF (Drainage Filtration)

Replace paragraph one with the following effective with the December 2017 letting:

(1) Furnish fabric conforming with the physical requirements of either schedule A, schedule B, or schedule C as the contract specifies.

SCHEDULE A TEST	METHOD	VALUE[1]
Minimum grab tensile strength	ASTM D4632	110 lb
Minimum puncture strength	ASTM D6241	200 lb
Minimum apparent breaking elongation	ASTM D4632	30%
Maximum apparent opening size	ASTM D4751	300 µm
Minimum permittivity	ASTM D4491	0.70 s^{-1}

SCHEDULE B TEST	METHOD	VALUE[1]
Minimum grab tensile strength	ASTM D4632	180 lb
Minimum puncture strength	ASTM D6241	350 lb
Minimum apparent breaking elongation	ASTM D4632	30%
Maximum apparent opening size	ASTM D4751	300 µm
Minimum permittivity	ASTM D4491	1.35 s^{-1}

SCHEDULE C TEST	METHOD	VALUE[1]
Minimum grab tensile strength	ASTM D4632	180 lb
Minimum puncture strength	ASTM D6241	350 lb
Minimum apparent breaking elongation	ASTM D4632	15%
Maximum apparent opening size	ASTM D4751	600 µm
Minimum permittivity	ASTM D4491	1.00 s^{-1}

[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

645.2.2.6 Geotextile, Type R (Riprap)

Replace paragraph one with the following effective with the December 2017 letting:

(1) Use fabric conforming to the following physical properties:

TEST	METHOD	VALUE[1]
Minimum grab tensile strength	ASTM D4632	205 lb
Minimum puncture strength	ASTM D6241	400 lb
Minimum apparent breaking elongation	ASTM D4632	15%
Maximum apparent opening size	ASTM D4751	No. 30
Minimum permittivity	ASTM D4491	0.12 s^{-1}

[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

645.2.2.7 Geotextile, Type HR (Heavy Riprap)

Replace paragraph one with the following effective with the December 2017 letting:

(1) Use fabric conforming to the following physical properties:

TEST	METHOD	VALUE[1]
Minimum grab tensile strength, lb	ASTM D4632	305 lb
Minimum puncture strength, lb	ASTM D6241	500 lb
Minimum apparent breaking elongation, %	ASTM D4632	15%
Maximum apparent opening size	ASTM D4751	No. 30
Minimum permittivity	ASTM D4491	0.40, s^{-1}

[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

645.2.2.8 Geotextile, Type C (Modified SAS)

Replace paragraph one with the following effective with the December 2017 letting:

(1) Use fabric conforming to the following physical properties:

TEST	METHOD	VALUE[1]
Grab tensile strength, lb	ASTM D4632	205 lb
Puncture strength, lb	ASTM D6241	350 lb
Maximum apparent opening size	ASTM D4751	No. 50
Minimum permittivity	ASTM D4491	0.12 s^{-1}

[1] All numerical values represent minimum/maximum average roll values. Average test results from all rolls in a lot must conform to the tabulated values.

646.3.1.1 General Marking

Replace paragraph one with the following effective with the December 2017 letting:

(1) Prepare the surface and apply marking as the manufacturer specifies. Provide manufacturer specifications as the engineer requests. Do not mark over a marking product with less adherence or over chipped or peeled marking. Do not remove polymer overlay materials in areas receiving pavement marking. Use only epoxy pavement marking where the contract requires marking placed on polymer overlays.

Replace paragraph five with the following effective with the December 2017 letting:

(5) After the marking can sustain exposure to traffic, re-apply clear protective surface treatment conforming to 502.2.11 where removed from structures during marking surface preparation. Seal exposed concrete including grooves for tape. Cover marking during resealing with a system that will not degrade the marking's retroreflectivity when removed. Uncover marking before opening to traffic.

701.3 Contractor Testing

Replace paragraph one with the following effective with the December 2017 letting:

(1) Perform contract required QC tests for samples randomly located according to CMM 8-30. Also perform other tests as necessary to control production and construction processes, and additional testing enumerated in the contractor's quality control plan or that the engineer directs. Use test methods as follows:

TABLE 701-2 TESTING STANDARDS

TEST	TEST STANDARD
Washed P 200 analysis	AASHTO T11[1]
Sieve analysis of fine and coarse aggregate	AASHTO T27[1]
Aggregate moisture	AASHTO T255[1]
Sampling freshly mixed concrete	AASHTO R60
Air content of fresh concrete	AASHTO T152[2]
Air void system of fresh concrete	AASHTO Provisional Standard TP118
Concrete slump	AASHTO T119[2]
Concrete temperature	ASTM C1064
Concrete compressive strength	AASHTO T22
Making and curing concrete cylinders	AASHTO T23
Standard moist curing for concrete cylinders	AASHTO M201

[1] As modified in CMM 8-60.

[2] As modified in CMM 8-70.

715.2.3.1 Pavements

Add the following as paragraph six effective with the December 2017 letting:

(6) For new lab-qualified mixes, test the air void system of the proposed concrete mix conforming to AASHTO provisional standard TP 118. Include the SAM number as a part of the mix design submittal.

715.3.1.1 General

Replace paragraph one with the following effective with the December 2017 letting:

(1) Provide slump, air content, concrete temperature and compressive strength test results as specified in 710.5. Provide a battery of QC tests, consisting of results for each specified property, using a single sample randomly located within each sublot. Cast three cylinders for strength evaluation. For pavement concrete, also test the air void system conforming to AASHTO provisional standard TP118 at least once per lot and enter the SAM number in the MRS for information only.

715.3.1.3 Department Verification Testing

Replace paragraph one with the following effective with the December 2017 letting:

(1) The department will perform verification testing as specified in 701.4.2 with additional testing as required to obtain at least 1 verification test per lot for air content, slump, temperature, and compressive strength.

Errata

Make the following corrections to the standard specifications:

106.3.3.1 General

Correct errata by changing "acceptance" to "approval".

(1) For manufactured products or assemblies, the department may base approval on a product certification or require both a product certification and production plant certification.

205.3.1 General

Correct errata by replacing paragraphs three and four with the following to reflect current practice to incorporate suitable materials.

(3) Replace unsuitable material with satisfactory material. Trim and finish the roadway. Maintain the work done under 205 in a finished condition until acceptance.

305.1 Description

Correct errata to clarify that the contractor may use more than one material under a single contract.

(1) This section describes constructing a dense graded base using one or more of the following aggregates at the contractor's option:

Crushed stone	Reclaimed asphalt
Crushed gravel	Reprocessed material
Crushed concrete	Blended material

521.2 Materials

Correct errata by deleting bullet three and including aluminum coated pipe in bullet one.

(1) Furnish corrugated steel pipe and steel apron end walls as follows:

- Corrugated steel culvert pipe, steel apron endwalls, aluminum coated corrugated steel culvert pipe, and other components conforming to AASHTO M36.
- Polymer coated corrugated steel culvert pipe and pipe arch fabricated from zinc coated sheet steel conforming to AASHTO M218. Before fabrication, coat the sheets on both sides with polymer protective coating grade 250/250 according to AASHTO M246. Fabricate the pipe according to AASHTO M245.

614.3.2.2 Installing Rail

Correct errata for splice location and allow punching or drilling holes and slots.

(1) Install rail with lap splices in the direction of traffic. Ensure that the number and dimensions of holes and bolts conforms to the plan details for new splices. Place the round head of bolts on the traffic side.

(2) Cut rails to length by shearing or sawing; do not use cutting torches. Drill or punch bolt holes and slots; ensure that they are burr free. After installation, cut anchor bolts that project more than one inch from the nut to 1/2 inch from the nut; deburr the threaded end of cut bolts.

618.1 Description

Correct errata by deleting designated detours from the scope of Maintenance and Repair of Haul Roads.

(1) This section describes maintaining, repairing, and restoring all public roads, streets, drainage facilities, and other components used for hauling by contractor, subcontractor, or supplier to support work for a department contract to its pre-haul condition. Public roads and streets shall be limited to those not a part of the State Trunk Highway System and from now on called haul roads.

643.3.5.2 Cellular Communication

Correct errata by changing State Traffic Operations Center to Traffic Management Center.

(2) A minimum of 14 days before deployment, demonstrate to the department that the cellular modem is capable of communications with the Traffic Management Center. If remote communications are interrupted or temporarily unavailable, the department will notify the contractor to change messages manually. Update messages within 2 hours of receiving notification.

646.3.1.2 Liquid Marking

Correct errata by changing "epoxy overlays" to "polymer overlays".

(5) Apply liquid marking and glass beads across the line at or exceeding the following:

LIQUID MARKING	PAVEMENT TYPE	THICKNESS (mils)	BEAD APPLICATION (pounds per gallon)
Paint	all	16	8-10
Epoxy	SMA, seal coats, and polymer overlays	25	25
Epoxy	all other	20	22.5

654.5 Payment

Correct errata to clarify that contractor-provided anchor rods and associated hardware are incidental.

(2) Payment for the Bases bid items is full compensation for providing concrete bases; for embedded conduit and electrical components; for anchor rods, nuts, and washers; for bar steel reinforcement; and for excavating, backfilling, and disposing of surplus materials.

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.

NOTE: CRCS Prime Contractor payment is currently not automated and will need to be manually loaded into the Civil Rights Compliance System. Copies of prime contractor payments received (check or ACH) will have to be forwarded to paul.ndon@dot.wi.gov within 5 days of payment receipt to be logged manually.

***Additionally, for information on Subcontractor Sublet assignments, Subcontractor Payments and Payment Tracking, please refer to the CRCS Payment and Sublets manual at:

http://wisconsindot.gov/Documents/doing-bus/civil-rights/labornwage/crcs-payments-sublets-manual.pdf

ADDITIONAL SPECIAL PROVISION 9-S
Electronic Labor Data Submittal for
State Funded Only Projects

(1) Use the Workforce Utilization Report Microsoft Excel spread sheet, or other compatible spread sheet (i.e., Google Spread Sheet), to report required labor data. Details and the Excel spreadsheet are available online through the department's highway construction contract 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, including all trucking firms, submit their labor data electronically via the Excel spread sheet to the prime contractor within 14 calendar days of the end of each quarter (quarters are defined as January-March, April-June, July-September, and October-December). The prime contractor shall coordinate collection of their subcontractors' spread sheets and forward them to the Regional Labor Compliance Specialist within 21 calendar days of the end of each quarter. Every company or contractor providing physical labor towards completing the project is a subcontractor under this special provision.

(3) Upon receipt of contract execution, promptly make all affected companies or contractors aware of the requirements under this special provision and arrange for them to receive an Excel spreadsheet as part of their subcontract documents.

(4) The department will reject all paper submittals of information required under this special provision. All costs for conforming to this special provision are incidental to the contract.

Non-discrimination Provisions

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. Compliance with Regulations: The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. Non-discrimination: The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

3. Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Non-discrimination on the grounds of race, color, or national origin.

4. Information and Reports: The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the Federal Highway Administration to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the Recipient or the Federal Highway Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance: In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to:

a. Withholding payments to the contractor under the contract until the contractor complies; and/or
b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. Incorporation of Provisions: The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the Recipient or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

Pertinent Non-Discrimination Authorities:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21.
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et seq.), (prohibits discrimination on the basis of sex);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR Part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);

- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures Non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of Limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

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/hcciDocs/contracting-info/ws4567.doc

March 2017

NOTICE TO BIDDERS
WAGE RATE DECISION

The wage rate decision of the Department of Labor which has been incorporated in these advertised specifications is incomplete in that the classifications may be omitted from the Department of Labor's decision.

Since the bidder is responsible, independently, for ascertaining area practice with respect to the necessity, or lack of necessity, for the use of these classifications in the prosecution of the work contemplated by this project, no inference may be drawn from the omission of these classifications concerning prevailing area practices relative to their use. Further, this omission will not, per se, be construed as establishing any governmental liability for increased labor cost if it is subsequently determined that such classifications are required.

There may be omissions and/or errors in the federal wage rates. The bidder is responsible for evaluating and determining the correct applicable rate.

If a project includes multiple types of construction (highway, bridge over navigable water, sanitary sewer and water main, building) and there is not a separate wage determination for this type of work included in the proposal, use the wage determination that is in the proposal.

Proposal ID: 20180710009 Project(s): 1060-62-70

Federal ID(s): N/A

SECTION: 0001 Contract Items

Alt Set ID: Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price	Bid Amount
0002	201.0105 Clearing	5.000 STA	_____.____	_____.____
0004	201.0205 Grubbing	5.000 STA	_____.____	_____.____
0006	203.0100 Removing Small Pipe Culverts	1.000 EACH	_____.____	_____.____
0008	204.0110 Removing Asphaltic Surface	861.000 SY	_____.____	_____.____
0010	205.0100 Excavation Common	37,210.000 CY	_____.____	_____.____
0012	208.0100 Borrow	2,561.000 CY	_____.____	_____.____
0014	209.1500 Backfill Granular Grade 1	119.000 TON	_____.____	_____.____
0016	305.0120 Base Aggregate Dense 1 1/4-Inch	3,506.000 TON	_____.____	_____.____
0018	310.0110 Base Aggregate Open-Graded	246.000 TON	_____.____	_____.____
0020	311.0110 Breaker Run	1,568.000 TON	_____.____	_____.____
0022	415.0080 Concrete Pavement 8-Inch	1,130.000 SY	_____.____	_____.____
0024	455.0605 Tack Coat	388.100 GAL	_____.____	_____.____
0026	460.2000 Incentive Density HMA Pavement	410.000 DOL	1.00000	410.00
0028	460.6223 HMA Pavement 3 MT 58-28 S	418.800 TON	_____.____	_____.____
0030	460.6224 HMA Pavement 4 MT 58-28 S	209.400 TON	_____.____	_____.____
0032	465.0105 Asphaltic Surface	487.400 TON	_____.____	_____.____

Proposal ID: 20180710009 Project(s): 1060-62-70

Federal ID(s): N/A

SECTION: 0001 Contract Items

Alt Set ID: Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price	Bid Amount
0034	522.0412 Culvert Pipe Reinforced Concrete Class IV 12-Inch	112.000 LF	_____.____	_____.____
0036	522.0418 Culvert Pipe Reinforced Concrete Class IV 18-Inch	184.000 LF	_____.____	_____.____
0038	522.1012 Apron Endwalls for Culvert Pipe Reinforced Concrete 12-Inch	3.000 EACH	_____.____	_____.____
0040	522.1018 Apron Endwalls for Culvert Pipe Reinforced Concrete 18-Inch	5.000 EACH	_____.____	_____.____
0042	606.0100 Riprap Light	7.090 CY	_____.____	_____.____
0044	608.0412 Storm Sewer Pipe Reinforced Concrete Class IV 12-Inch	37.000 LF	_____.____	_____.____
0046	608.0418 Storm Sewer Pipe Reinforced Concrete Class IV 18-Inch	71.000 LF	_____.____	_____.____
0048	611.0545 Manhole Covers Type L	2.000 EACH	_____.____	_____.____
0050	611.0612 Inlet Covers Type C	1.000 EACH	_____.____	_____.____
0052	611.3003 Inlets 3-FT Diameter	2.000 EACH	_____.____	_____.____
0054	611.3004 Inlets 4-FT Diameter	1.000 EACH	_____.____	_____.____
0056	611.8120.S Cover Plates Temporary	1.000 EACH	_____.____	_____.____
0058	612.0106 Pipe Underdrain 6-Inch	334.000 LF	_____.____	_____.____
0060	612.0112 Pipe Underdrain 12-Inch	50.000 LF	_____.____	_____.____
0062	612.0212 Pipe Underdrain Unperforated 12-Inch	65.000 LF	_____.____	_____.____

Proposal ID: 20180710009 Project(s): 1060-62-70

Federal ID(s): N/A

SECTION: 0001 Contract Items

Alt Set ID: Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price	Bid Amount
0064	619.1000 Mobilization	1.000 EACH	_____.____	_____.____
0066	624.0100 Water	53.190 MGAL	_____.____	_____.____
0068	625.0100 Topsoil	2,654.000 SY	_____.____	_____.____
0070	625.0500 Salvaged Topsoil	9,890.000 SY	_____.____	_____.____
0072	627.0200 Mulching	12,462.000 SY	_____.____	_____.____
0074	628.1504 Silt Fence	1,402.000 LF	_____.____	_____.____
0076	628.1520 Silt Fence Maintenance	701.000 LF	_____.____	_____.____
0078	628.1905 Mobilizations Erosion Control	2.000 EACH	_____.____	_____.____
0080	628.1910 Mobilizations Emergency Erosion Control	4.000 EACH	_____.____	_____.____
0082	628.2023 Erosion Mat Class II Type B	12,544.000 SY	_____.____	_____.____
0084	628.6510 Soil Stabilizer Type B	2.570 ACRE	_____.____	_____.____
0086	628.7010 Inlet Protection Type B	1.000 EACH	_____.____	_____.____
0088	628.7504 Temporary Ditch Checks	167.000 LF	_____.____	_____.____
0090	628.7555 Culvert Pipe Checks	6.000 EACH	_____.____	_____.____
0092	628.7570 Rock Bags	35.000 EACH	_____.____	_____.____
0094	629.0210 Fertilizer Type B	7.890 CWT	_____.____	_____.____
0096	630.0160 Seeding Mixture No. 60	169.100 LB	_____.____	_____.____

Proposal ID: 20180710009 Project(s): 1060-62-70

Federal ID(s): N/A

SECTION: 0001 Contract Items

Alt Set ID: Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price	Bid Amount
0098	630.0200 Seeding Temporary	336.500 LB	_____.____	_____.____
0100	632.0101 Trees (species) (size) (root) 01. Norway Spruce 6-8' Ht B+B	12.000 EACH	_____.____	_____.____
0102	633.5200 Markers Culvert End	8.000 EACH	_____.____	_____.____
0104	640.1303.S Pond Liner Clay	639.000 CY	_____.____	_____.____
0106	642.5001 Field Office Type B	1.000 EACH	_____.____	_____.____
0108	645.0111 Geotextile Type DF Schedule A	148.000 SY	_____.____	_____.____
0110	645.0130 Geotextile Type R	849.600 SY	_____.____	_____.____
0112	650.4000 Construction Staking Storm Sewer	7.000 EACH	_____.____	_____.____
0114	650.4500 Construction Staking Subgrade	1,038.000 LF	_____.____	_____.____
0116	650.5000 Construction Staking Base	1,038.000 LF	_____.____	_____.____
0118	650.6000 Construction Staking Pipe Culverts	4.000 EACH	_____.____	_____.____
0120	650.7000 Construction Staking Concrete Pavement	334.000 LF	_____.____	_____.____
0122	650.9910 Construction Staking Supplemental Control (project) 01. 1060-62-70	 LS	LUMP SUM	_____.____
0124	650.9920 Construction Staking Slope Stakes	1,336.000 LF	_____.____	_____.____
0126	690.0150 Sawing Asphalt	431.000 LF	_____.____	_____.____
0128	715.0415 Incentive Strength Concrete Pavement	500.000 DOL	1.00000	500.00

Proposal ID: 20180710009 Project(s): 1060-62-70

Federal ID(s): N/A

SECTION: 0001 Contract Items

Alt Set ID: Alt Mbr ID:

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price	Bid Amount
0130	SPV.0035 Special 01. Pea Gravel	16.000 CY	_____._____	_____._____
0132	SPV.0055 Special 01. Natural Gas Service	5,000.000 DOL	1.00000	5,000.00
0134	SPV.0105 Special 01. STATIC SCALE SYSTEM	LS	LUMP SUM	_____._____
0136	SPV.0105 Special 02. UNDERGROUND DETENTION WASTEWATER TANK, 10-FT DIAMETER	LS	LUMP SUM	_____._____
0138	SPV.0105 Special 03. Brining Building General Construction	LS	LUMP SUM	_____._____
0140	SPV.0105 Special 04. Brining Building Plumbing	LS	LUMP SUM	_____._____
0142	SPV.0105 Special 05. Brining Building Heating and Ventilation	LS	LUMP SUM	_____._____
0144	SPV.0105 Special 06. Brining Building Electrical	LS	LUMP SUM	_____._____
0146	SPV.0105 Special 07. Salt Storage Shed	LS	LUMP SUM	_____._____
0148	SPV.0105 Special 08. Water Service	LS	LUMP SUM	_____._____
0150	SPV.0105 Special 09. Electrical Service	LS	LUMP SUM	_____._____
0152	SPV.0105 Special 10. Site Lighting	LS	LUMP SUM	_____._____
	Section: 0001		Total:	_____._____

Total Bid: _____._____

PLEASE ATTACH SCHEDULE OF ITEMS HERE