

HIGHWAY WORK PROPOSAL

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

Proposal Number:

Ø 3

COUNTY	STATE PROJECT ID	FEDERAL PROJECT ID	PROJECT DESCRIPTION	HIGHWAY
Monroe	1070-00-72	WISC 2016 246	La Crosse – Tomah Road (Sparta Safety & Weight Facility #54)	IH 90
La Crosse	1070-00-73	WISC 2016 247	La Crosse – Tomah Road (West Salem Safety & Weight Facility #53)	IH 90

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

Proposal Guaranty Required, \$ 260,000.00 Payable to: Wisconsin Department of Transportation	Attach Proposal Guaranty on back of this PAGE.
Bid Submittal Due Date: July 12, 2016 Time (Local Time): 9:00 AM	Firm Name, Address, City, State, Zip Code
Contract Completion Time November 15, 2017	SAMPLE NOT FOR BIDDING PURPOSES
Assigned Disadvantaged Business Enterprise Goal 5 %	This contract is exempt from federal oversight.

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

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

Subscribed and sworn to before me this date _____

(Signature, Notary Public, State of Wisconsin)

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

(Date Commission Expires)

Notary Seal

(Bidder Signature)

(Print or Type Bidder Name)

(Bidder Title)

For Department Use Only

Type of Work Grading, base aggregate, storm sewer, culvert pipe, HMA pavement, concrete pavement, concrete curb and gutter, permanent signing, pavement marking, lighting, plantings, landscaping, building, weigh-in-motion system, and static scale.	
Notice of Award Dated	Date Guaranty Returned

**PLEASE ATTACH
PROPOSAL GUARANTY HERE**

Effective with November 2007 Letting

PROPOSAL REQUIREMENTS AND CONDITIONS

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

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

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

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

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

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

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

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

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

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

In connection with the performance of work under this contract, the contractor agrees to comply with all applicable state and federal statutes relating to non-discrimination in employment. No otherwise qualified person shall be excluded from employment or otherwise be subject to discrimination in employment in any manner on the basis of age, race, religion, color, gender, national origin or ancestry, disability, arrest or conviction record (in keeping with s.111.32), sexual orientation, marital status, membership in the military reserve, honesty testing, genetic testing, and outside use of lawful products. This provision shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation, and selection for training, including apprenticeship. The contractor further agrees to ensure equal opportunity in employment to all applicants and employees and to take affirmative action to attain a representative workforce.

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

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

Effective with August 2015 Letting

BID PREPARATION

Preparing the Proposal Schedule of Items

A General

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

- (3) The department will provide bidding information through the department's web site at:
<http://wisconsindot.gov/Pages/doing-bus/contractors/hcci/bid-let.aspx>

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

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

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

- (5) The department will address equipment and process failures, if the bidder can demonstrate that those failures were beyond their control.
- (6) Contractors are responsible for checking on the issuance of addenda and for obtaining the addenda. Notice of issuance of addenda is posted on the department's web site at:
<http://wisconsindot.gov/Pages/doing-bus/contractors/hcci/bid-let.aspx>

or by calling the department at (608) 266-1631. Addenda can ONLY be obtained from the departments web site listed above or by picking up the addenda at the Bureau of Highway Construction, Room 601, 4802 Sheboygan Avenue, Madison, WI, during regular business hours.

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

B Submitting Electronic Bids

B.1 On the Internet

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

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

- (1) Download the latest schedule of items from the Wisconsin pages of the Bid ExpressTM web site reflecting the latest addenda posted on the department's web site at:
<http://wisconsindot.gov/Pages/doing-bus/contractors/hcci/bid-let.aspx>

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

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

Bidder

Name

BN00

Proposals: 1, 12, 14, & 22

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

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

C Waiver of Electronic Submittal

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

PROPOSAL BID BOND

DT1303 1/2006

Wisconsin Department of Transportation

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

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

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

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

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

PRINCIPAL

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

(Signature and Title)

(Company Name)

(Signature and Title)

(Company Name)

(Signature and Title)

(Company Name)

(Signature and Title)

NOTARY FOR PRINCIPAL

(Date)

State of Wisconsin)
) ss.
_____ County)

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

(Signature, Notary Public, State of Wisconsin)

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

(Date Commission Expires)

Notary Seal

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

(Signature of Attorney-in-Fact)

NOTARY FOR SURETY

(Date)

State of Wisconsin)
) ss.
_____ County)

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

(Signature, Notary Public, State of Wisconsin)

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

(Date Commission Expires)

Notary Seal

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

CERTIFICATE OF ANNUAL BID BOND

DT1305 8/2003

Wisconsin Department of Transportation

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

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

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

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

(Signature of Authorized Contractor Representative)

(Date)

March 2010

LIST OF SUBCONTRACTORS

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

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

[illegible]

DECEMBER 2000

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

Instructions for Certification

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

modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

8. The contractor may rely upon a certification of a prospective subcontractor/materials supplier that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A contractor may decide the method and frequency by which it determines the eligibility of its principals. Each contractor may, but is not required to, check the Disapproval List (telephone # 608/266/1631).
9. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
10. Except for transactions authorized under paragraph 6 of these instructions, if a contractor in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department may terminate this transaction for cause or default.

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

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

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SPECIAL PROVISIONS

1. General.

Perform the work under this construction contract for Project 1070-00-72, La Crosse – Tomah Road, (Sparta Safety & Weight Facility #54), IH-90, Monroe County, Wisconsin and for Project 1070-00-73, La Crosse – Tomah Road, (West Salem Safety & Weight Facility #53), IH-90, La Crosse County, Wisconsin as the plans show and execute the work as specified in the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, 2016 Edition, as published by the department, and these special provisions.

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

100-005 (20151210)

2. Referenced Construction Specifications.

Building Construction shall conform to the “General Conditions of the Contract for Construction” AIA Document A201 - 2007, published by the American Institute of Architects.

If there is a discrepancy or conflict between the referenced specification and the standard specifications regarding contract administration, part 1 of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, 2016 Edition governs.

3. Scope of Work.

The work under this contract shall consist of grading, base aggregate, storm sewer, culvert pipe, HMA pavement, concrete pavement, concrete curb and gutter, permanent signing, pavement marking, lighting, plantings, landscaping, building, weigh-in-motion system, static scale, and all incidental items necessary to complete the work as shown on the plans and included in the proposal and contract.

104-005 (20090901)

4. Prosecution and Progress.

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

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

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

Indicate on the schedule of operations, working with a large force and providing adequate equipment to ensure that the work will be completed within the established contract time.

Be advised that there may be multiple mobilizations for such items as: traffic control, signing items, temporary pavement marking, salvaged topsoil, seeding, mulching, drainage items and other incidental items related to staging. No additional payment will be made, by the department, for said mobilizations.

Prior to construction operations, enclose the proposed private on-site wastewater treatment system location with safety fence to prevent equipment from entering and storage of materials in this area. The cost of the safety fence is incidental to the cost of the private on-site wastewater treatment system.

Excavation waste from earthwork operations on the proposed Sparta SWEF site is to remain on-site in the form of an earthen berm located on the south-side of the site as shown in the plans. An additional earthen berm location on the eastside of the site as shown in the plans can also be used for excess excavation waste if needed.

Winter Maintenance

After written notice to proceed, and prior to Final Acceptance of work, assist with the maintenance of roadways as specified in standard spec 104.6.1. Monroe County will perform snow removal operations along IH 90 for freeways and ramps open to traffic. Provide for snow removal along the Sparta SWEF exit and entrance ramps to facilitate safe construction operations and as required to eliminate snow melt run-off from crossing IH 90 and ensure snow and ice are not tracked onto the IH 90 traffic lanes by construction vehicle traffic using the exit and entrance ramps during construction operations.

Northern Long-eared Bat (*Myotis septentrionalis*)

Northern Long-eared Bats (NLEB) have the potential to inhabit the project limits because they roost in trees and structures (bridges, culverts, buildings). Roosts may not have been observed on this project, but conditions to support the species exist. The species and all active roosts are protected by the Federal Endangered Species Act.

In order to avoid adverse impacts upon the NLEBs, no vegetation clearing and grubbing within the identified clearing and grubbing limits will be allowed from April 1 to September 30.

If the required clearing and removal is not completed by March 31, the department will suspend all clearing and associated work directly impacted by clearing. The department will issue a notice to proceed with clearing and associated work directly impacted by clearing after consulting with the United States Fish and Wildlife Service (USFWS).

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

B Definitions

The following definitions apply to this contract:

Peak Traffic Periods

- 7:00 AM to 8:00 PM (Tuesday, Wednesday, and Thursday)
- 7:00 AM to 8:00 PM (Friday AM to Monday PM)

Off-Peak Traffic Periods

- 8:00 PM Monday, Tuesday, Wednesday, and Thursday to 7:00 AM the following day

Temporary Lane Closures. A lane closed to traffic during off-peak traffic periods and open during peak traffic periods.

Lane. A lane is defined as 12-feet wide unless otherwise shown on the plans.

C Advance Notification

Provide the required minimum advance notification to the engineer for incorporation into the Wisconsin Lane Closure System.

Notify the engineer if there are any changes in the schedule, early completions, or cancellations of scheduled work.

All temporary lane closures during off-peak traffic periods must be approved by the engineer 3 days prior to implementation.

Use portable changeable message signs one week in advance of and during highway lane alterations to indicate such alterations and to notify drivers of changing traffic patterns.

D All Work Restrictions

Comply with all local ordinances, which apply to operations, when working during nighttime working hours. Furnish to the engineer in writing any ordinance variance issued by the municipality or required permits before performing such work.

Do not begin or continue any work that closes traffic lanes outside of the off-peak traffic periods specified in this article or the article "Traffic". If the contractor fails to open all lanes of traffic by the specified times, then a reduction of \$3,000 per hour per traffic lane for each hour of lane closure violations will be made from monies due him. This reduction shall be a quarterly fraction of the \$3,000 hourly reduction rate for each 15-minute increment during which the lane closure violation occurs. The total reduction from monies due to the contractor shall be the summation of the separate reductions for each lane closure violation. Hourly deductions will be assessed under the administrative item 801.0104 Failing to Open Road to Traffic.

Do not directly cross the live lanes of IH 90 with any vehicle or piece of construction equipment.

Do not use maintenance crossings connecting eastbound and westbound roadways of IH 90 during construction operations unless the median lanes are closed to traffic.

Flagging operations will not be permitted on IH 90.

Hauling of materials onto the SWEF site via IH 90 may be halted at the discretion of the engineer during times of traffic congestion along IH 90.

Equip vehicles with a tailgate and adequate sideboards when hauling material subject to spillage on all roadways. Use covers and/or other protective devices to prevent spillage as directed by the engineer. Immediately clean up any debris or spillage that falls onto live traffic lanes or shoulders.

Cover completely any conflicting signs in the project area.

Do not leave any slopes steeper than 3:1 within the clear zone or any drop-offs at the edge of the traveled way greater than 2-inches. If unsure whether an individual construction operation will meet the safety requirements for working within the IH 90 clear zone, review the proposed construction operation with the engineer before proceeding with the work.

Vehicles parked within the right-of-way of IH 90 and not engaged in construction operations must be located more than 30 feet from the edge of the live traffic lane. Equip all vehicles and equipment entering or leaving the live traffic lanes on IH 90 with a hazard identification beacon (flashing yellow signal) of 8-inch diameter. Activate the beacon when merging or exiting a live traffic lane. All vehicles and equipment entering or exiting live traffic lanes yield to through traffic. Authorized vehicles will be allowed to park along the right shoulder of IH 90 only when there is no other access to the work area.

Provide the engineer with a hauling plan prior to the pre-construction conference. Include the proposed locations of points of entry and traffic control to be used. Obtain approval from the engineer for all arrangements for handling traffic during construction operations.

E Schedule of Operations

Conform to the schedule of operations and the construction staging as shown in the traffic control plans and as described herein unless modifications to the schedule are approved in writing by the engineer.

Substantial Completion Date Sparta SWEF #54

The Substantial Completion date for the Sparta SWEF #54 shall be Monday, September 18, 2017. The Substantial Completion date is defined as the date in which the progress of the work is sufficiently complete for the owner and/or owner's representative and/or the engineer occupy and use the fully operational facility, receive equipment training and develop the final punch list. The Substantial Completion date is also the date of commencement of applicable warranties required by the contract documents. If the facility is not substantially complete prior to 12:01 AM September 19, 2017, a deduction of \$1,940 per calendar day, will be made from money due under this contract for Project 1070-00-72 for each calendar day the contract work remains incomplete. An entire calendar day will be charged for any period of time within a calendar day that the work remains incomplete beyond 12:01 AM.

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

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

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

Exit Ramp to Sparta SWEF

Complete construction operations at the Sparta SWEF exit ramp taper prior to November 15, 2016 and so that the IH 90 traffic shifts as detailed in the plan is used for a maximum of 20 calendar days. Do not reopen until completing the ramp paving and shouldering through the ramp exit gore. If the contractor fails to complete the work necessary to remove the traffic shifts and return traffic to the existing roadway lanes within 20 calendar days, the department will assess the contractor \$1,690 in interim liquidated damages for each calendar day contract work remains incomplete beyond 20 calendar days. An entire calendar day will be charged for any period of time within a calendar day that the contract work remains incomplete beyond 12:01 AM.

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

Entrance Ramp from Sparta SWEF

Complete construction operations at the Sparta SWEF entrance ramp taper prior to November 15, 2016 and so that the IH 90 traffic shifts as detailed in the plan is used for a maximum of 35 calendar days. Do not reopen until completing the ramp paving and shouldering through the ramp entrance gore. If the contractor fails to complete the work

necessary to remove the traffic shifts and return traffic to the existing roadway lanes within 35 calendar days, the department will assess the contractor \$1,690 in interim liquidated damages for each calendar day contract work remains incomplete beyond 35 calendar days. An entire calendar day will be charged for any period of time within a calendar day that the contract work remains incomplete beyond 12:01 AM.

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

Sparta SWEF Mainline WIM

Complete construction operations at the Sparta SWEF mainline weigh-in-motion (WIM) location along IH 90 utilizing temporary lane closures during off-peak traffic periods except for one continuous twenty-four (24) hour lane closure. The date for the lane closure must be approved by the engineer.

Sparta SWEF VWS on STH 16

Complete construction operations at the Sparta SWEF virtual weigh station (VWS) along STH 16 prior to September 18, 2017 and so that the STH 16 temporary traffic signals as detailed in the plan is used for a maximum of 30 calendar days. Do not reopen until completing the following work: paving mainline and shoulder, VWS system installation, pavement marking, permanent signing and landscaping. If the contractor fails to complete the work necessary to remove the temporary traffic signals and return traffic to the existing roadway lanes within 30 calendar days, the department will assess the contractor \$1,690 in interim liquidated damages for each calendar day contract work remains incomplete beyond 30 calendar days. An entire calendar day will be charged for any period of time within a calendar day that the contract work remains incomplete beyond 12:01 AM.

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

West Salem SWEF Removal

Complete construction operations at the existing West Salem SWEF location along IH 90 utilizing temporary lane closures during off-peak traffic periods.

Wisconsin Lane Closure System Advance Notification

Provide the following advance notification to the engineer for incorporation into the Wisconsin Lane Closure System (LCS).

TABLE 108-1 CLOSURE TYPE AND REQUIRED MINIMUM ADVANCE NOTIFICATION

Closure type with height, weight, or width restrictions (available width, all lanes in one direction $\leq 16'$)	MINIMUM NOTIFICATION
Lane and shoulder closures	14 calendar days
Full roadway closures	14 calendar days
System and service ramp closures	14 calendar days
Full system and service ramp closures	14 calendar days
Detours	14 calendar days
Closure type without height, weight, or width restrictions (available width, all lanes in one direction $> 16'$)	MINIMUM NOTIFICATION
Lane and shoulder closures	3 business days
System and service ramp closures	3 business days
Modifying all closure types	3 business days

Discuss LCS completion dates and provide changes in the schedule to the engineer at weekly project meetings in order to manage closures nearing their completion date.
108-057 (20150630)

5. Prosecution and Progress – Subletting the Contract.

Replace the first sentence of standard spec 108.1.2 with the following:

Perform at least 20 percent of the original contract amount with the contractor's own organization.

6. Traffic.

A General

IH 90 shall remain open to all traffic with two lanes open in each direction at all times except as specified in this article.

The work under this contract shall be performed in a manner that will not interfere with the travel lanes and shoulders on IH 90 except as indicated on the plans. Do not haul across, unload material from, stop in, or otherwise interfere with traffic on any portion of IH 90 without a pre-approved traffic control plan and traffic control measures in place.

Traffic control for stage changes shall only be allowed during off-peak traffic periods.

B Schedule of Operations

The construction sequence and the associated traffic control will be accomplished as detailed on the plans and described herein.

Sparta SWEF site construction

Traffic along eastbound IH 90 during construction of the exit and entrance ramp tapers will be shifted towards the inside shoulder. Work on the IH 90 shoulder (SWEF exit/entrance ramp taper construction) is restricted to off-peak traffic periods only.

Mainline Weigh-In-Motion (WIM) construction

Traffic along eastbound IH 90 will be reduced down to one lane for a restricted period of time during construction of the mainline WIM area. Work on the mainline WIM area along IH 90 is restricted to closed off lanes or areas during off-peak traffic periods only, except for a single twenty-four (24) hour long continuous single lane closure to place the mainline WIM frame and scale in the IH 90 eastbound outside lane pavement. A temporary lane closure will be allowed during off-peak traffic periods to complete the installation of the remaining mainline WIM system components. Work may be performed during peak traffic periods provided such work operations do not include ingress and egress of vehicles, materials or equipment, which would obstruct the flow of traffic on the interstate.

Virtual Weigh Station (VWS) construction

Traffic along STH 16 during construction of the VWS area will be reduced down to one lane and temporary traffic signals will be utilized on both sides of the work zone to control traffic through the work zone.

West Salem site removal

Traffic along eastbound IH 90 will be reduced down to one lane for a temporary lane closure during off-peak traffic periods for removal of the existing exit and entrance ramps.

7. Holiday Work Restrictions.

Do not perform work on, nor haul materials of any kind along or across any portion of the highway carrying IH 90 and STH 16 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, September 2, 2016 to 6:00 AM Tuesday, September 6, 2016 for Labor Day;
- From noon Thursday, September 29, 2016 to 6:00 AM Monday, October 3, 2016 for Oktoberfest USA in La Crosse, WI;
- From noon Friday, November 18, 2016 to 6:00 AM Monday, November 21, 2016 for Deer Season Opening Weekend;
- From noon Wednesday, November 23, 2016 to 6:00 AM Monday, November 28, 2016 for Thanksgiving;
- From noon Friday, December 23, 2016 to 6:00 AM Monday, December 26, 2016 for Christmas;

- From noon Friday, December 30, 2016 to 6:00 AM Monday, January 2, 2017 for New Years;
- From noon Friday, May 26, 2017 to 6:00 AM Tuesday, May 30, 2017 for Memorial Day;
- From noon Friday, June 30, 2017 to 6:00 AM Monday, July 10, 2017 for Independence Day;
- From noon Friday, September 1, 2017 to 6:00 AM Tuesday, September 5, 2017 for Labor Day;
- From noon Thursday, September 28, 2017 to 6:00 AM Monday, October 2, 2017 for Oktoberfest USA in La Crosse, WI.

107-005 (20050502)

8. Utilities.

Project 1070-00-72

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

107-065 (20080501)

No existing utilities are located within the project area.

New Utility Service Connections: Coordinate all required utility work connections according to standard spec 107.22, and pay for the installation of new site utilities and tie-ins as may be necessary to complete the work as described below.

Include the following allowances for charges and work to be done by utilities in the total bid price for the appropriate items:

Telephone Service, Sparta SWEF: CenturyLink has existing service facilities located east of the proposed SWEF site. CenturyLink plans on providing an underground service along Icon Avenue to the proposed building location. Begin coordination to request telephone service three months in advance of desired service installation. A service request will need to be placed with the CenturyLink service center to create a service order.

Utility installation costs for telephone service to the project SWEF building network interface device location is to be paid for separately by the department.

Electrical Service, Sparta SWEF: Xcel Energy has existing service facilities located east of the proposed SWEF site along Ice Box Road. Xcel Energy plans on providing an underground service along Icon Avenue to the proposed building location. Xcel Energy will require ten days to complete the electric service installation to the proposed SWEF building during construction.

Xcel Energy has existing service facilities located south of the proposed mainline weigh-in-motion location along Jackpot Avenue. Xcel Energy plans on providing an underground service from Jackpot Avenue to the mainline weigh-in-motion location along

the south-side of IH 90. Xcel Energy will require five days to complete the electric service installation to the proposed mainline WIM site during construction.

Xcel Energy has existing service facilities adjacent to the proposed virtual weigh station (VWS) along the north-side of STH 16. Xcel Energy will require two days to complete the electric service installation to the proposed VWS site during construction.

Begin coordination to request electrical service three months in advance of desired service installation. A service request and application will need to be completed for each service location. Contact Kaye Crook at (608) 789-3677 Ext. 14 of Xcel Energy to coordinate electrical service installation efforts.

Utility installation costs for electric service to the project site transformer location is to be paid for separately by the department.

Network Service, Sparta SWEF: Wisconsin Independent Network (WIN) has an existing network fiber facility located on the north-side of the interstate. The plans include providing an underground service by installing conduit and fiber optic cable between an existing handhole and the proposed SWEF building including a directional bore under IH 90. Do not enter the existing WIN hand hole to complete any splicing operations. All splicing will be completed by a WIN representative.

Contact John Louis at (715) 838-4012 of Wisconsin Independent Network 45 days in advance to coordinate splicing operations and to verify proper placement of fiber between the existing handhole and proposed connection to the Sparta SWEF building.

All necessary splicing, terminations, and equipment connections at the proposed Sparta SWEF building is to be included as part of the telecommunications work inside the building.

Utility installation costs for the network connection are included as part of the project.

Natural Gas Service, Sparta SWEF: WE Energies Gas has existing service facilities located along Icon Avenue. WE Energies Gas plans on providing an underground service between the end of Icon Avenue to the proposed building location. WE Energies will require ten days to complete the natural gas service installation.

Begin coordination to request natural gas service four months in advance of desired service installation. A service request and application will need to be completed. Contact Kim Moon at (608) 366-2204 of WE Energies to coordinate natural gas service installation efforts.

Utility installation costs for natural gas service to the project SWEF building meter location is to be paid for separately by the department.

Project 1070-00-73

This contract does not come under the provisions of Wisconsin Administrative Code Chapter Trans 220.

There are no known utility facilities within the project limits.

9. Hauling Restrictions.

At all times conduct operations in a manner that will cause a minimum of inconvenience to the free flow of traffic along IH 90.

Median crossings connecting IH 90 eastbound and westbound roadways shall not be utilized by construction vehicles during construction operations.

10. Environmental Protection.

Supplement standard spec 107.18 as follows:

When engaged in roadway cleaning operations, the contractor shall use equipment having vacuum or water spray mechanisms to eliminate the dispersion of particulate matter into the atmosphere. If vacuum equipment is employed, it must have a suitable self-contained particulate collector to prevent discharge from the collection bin into the atmosphere.

Stockpiled spoil material shall be placed on an upland site an adequate distance from any open water created by excavation. Silt fence shall be installed between the spoil pile and excavation site and between any disturbed area and any open water. The silt fence shall be left in place until the seeded area has produced sufficient grass cover to stabilize the area and thereby reduce the danger of site erosion.

11. Erosion Control.

Supplement standard spec 107.20 with the following:

Pursue operations in a timely and diligent manner, continuing all construction operations methodically from the initial topsoil stripping operation through the subsequent grading and re-topsoiling to minimize the period of exposure to possible erosion.

Re-topsoil of graded areas, as designated by engineer, immediately after grading is completed within those areas. Seed, fertilize, and mulch all topsoiled areas within five calendar days after placement of topsoil.

Exposed and topsoiled areas not to be graded until spring of 2017 shall be seeded and/or temporarily seeded prior to October 15, 2016. In areas where seeding occurs after October 15, 2016, Soil Stabilizer, Type B and all other erosion control measures shall be applied as determined by the engineer.

Best management practices will be implemented for both temporary and permanent erosion control measures. These measures are outlined in the contract plans.

12. Intelligent Transportation Systems (ITS) – Control of Materials.

Standard spec 106.2 – Supply Source and Quality

Supplement standard spec 106.2 with the following:

The department will furnish a portion of equipment to be installed by the contractor. This department-furnished equipment includes the following:

Department-Furnished Items
Cable, Fiber Optic, 24-Count, Dielectric (1950 LF)
Combination Ethernet Switch and Terminal Server with Fiber Ports – Single Mode (1 EACH)
Termination Panel, Fiber Optic, 6-Count, ST (1 EACH)

Pick-up small department-furnished equipment, such as communications devices, cameras, and controllers, from the department’s Statewide Traffic Operations Center (STOC), 433 W. St. Paul Ave., Milwaukee, WI 53203, at a mutually agreed upon time during normal state office hours. Contact the department’s STOC at (414) 227-2166 to coordinate pick-up of equipment.

Large department-furnished equipment, such as camera poles will be delivered by the supplier to a contractor-controlled site within Monroe County. Delivery will not necessarily be in a “just in time” manner. Store the equipment until field installation. Provide location details and a contact for delivery coordination upon receiving the contract’s Notice to Proceed.

Transportation of the equipment between the electric shop and the field or interim location(s) shall be the responsibility of the contractor.

Standard spec 106.3 – Approval of Materials

Add the following to standard spec 106.3:

Design/Shop Drawings

Prior to the purchase and/or fabrication of any of the components listed herein, and for any non-catalog item shown on the Material and Equipment List specified above, and no more than 30 days after notice to proceed, submit five copies of design drawings and shop drawings, as required, to the department for review. The items and the drawings that represent them shall meet the requirements of the standard specifications.

Design drawing submissions shall consist of signed and certified designs, design drawings, calculations, and material specifications for required items.

Shop drawings will be required for, but not limited to the following:

1. Mounting assemblies for the vehicle speed and classification sensors, including their attachment to the structure.
2. Mounting LED warning signs to the sign structure.
3. Mounting detail for dynamic message signs.
4. Any contractor-designed structure or foundation.

The department will complete its review of the material within 30 days from the date of receipt of the submission, unless otherwise specified. The department will advise the contractor, in writing, as to the acceptability of the material submitted. The department may determine that if no exceptions were taken for the item, it is approved, and no further action is required by the contractor; or the item may be partially or totally rejected, in which case modify and/or amend the submittal as required by the department and resubmit the item within 14 days. At this time, the review and approval cycle described above will begin again.

670-005 (20150630)

13. Notice to Contractor, Notification of Demolition and/or Renovation No Asbestos Found.

Richard F. Stickler, License Number AII-425, inspected the existing West Salem SWEF building and storage shed for asbestos on January 17, 2013. No regulated Asbestos Containing Material (RACM) was found on this structure. A copy of the inspection report is available from: Robert Spoerl at (608) 266-8665 or robert.spoerl@dot.wi.gov.

According to NR447 and DHS159, ensure that DNR or DHS receives a completed Notification of Demolition and/or Renovation (DNR Form 4500-113 (R 4/11), or subsequent revision) via U.S. mail, hand-delivery, or using the online notification system at least 10 working days prior to beginning any construction or demolition. Pay all associated fees. Provide a copy of the completed 4500-113 form to Robert Spoerl at (608) 266-8665 and DOT BTS-ESS, Attn: Hazardous Materials Specialist PO Box 7965, Madison, WI, 53707-7965. In addition, comply with all local or municipal asbestos requirements.

Use the following information to complete WisDNR form 4500-113:

- Site Name: West Salem SWEF
- Site Address: W4100, Mile Post 10, Town of Hamilton, La Crosse County
- Ownership Information: WisDOT State Patrol
- Contact: Robert Spoerl
- Phone: (608) 266-8665
- Age: 26 years old. This structure was constructed in 1988.

Insert the following paragraph in Section 6.g.:

- If asbestos not previously identified is found or previously non-friable asbestos becomes crumbled, pulverized, or reduced to a powder, stop work immediately, notify the engineer, and the engineer will notify the department's Bureau of Technical Services at (608) 266-1476 for an emergency response in accordance to standard spec 107.24. Keep material wet until it is abated or until it is determined to be non-asbestos containing material.

107-125 (20120615)

14. Removing Buildings West Salem SWEF, Item 204.0235.

Conform to the requirements of standard spec 204 and as hereinafter specified.

The department has investigated the existing West Salem SWEF building and storage shed for the presence of asbestos. The inspection report was completed on February 1, 2013. No asbestos was positively located, but asbestos is assumed to be present within the paper insulation in the back of electrical service boxes and the white and silver foil insulation at the back of incandescent ceiling light fixtures. The identified paper/foil and/or transite insulation backing within the ceiling light fixtures and/or electrical services/service boxes in the building is to be removed once de-energized and prior to demolition by an abatement contractor.

In addition, the existing West Salem SWEF building and storage shed was investigated for the presence of lead based paint. The orange painted masonry walls and ceiling in the basement between the building and static scale pit reported positively for containing lead. The identified orange lead based paint is to be removed prior to demolition by an abatement contractor.

Contact the WisDOT Bureau of Highway Maintenance, Robert Spoerl at (608) 266-8665 or robert.spoerl@dot.wi.gov to obtain a copy of the Asbestos Pre-Demolition, Building Inspection & Bulk Sampling Investigation report.

Dispose of any and all materials associated with the buildings, including fuel tanks, underground pressure tanks, and lighting control cabinet as part of this item.

Coordinate electrical service termination with the utility. Remove electrical service to the building, street lights, and signs within the site. Abandon all existing conduits a minimum of 2-feet below finished grade. Restore areas disturbed by the removal of facilities.

Abandon wells and remove septic tanks within the site as separate items included in the contract.

15. QMP Base Aggregate.

A Description

A.1 General

- (1) This special provision describes contractor quality control (QC) sampling and testing for base aggregates, documenting those test results, and documenting related production and placement process changes. This special provision also describes department quality verification (QV), independent assurance (IA), and dispute resolution.
- (2) Conform to standard spec 301, standard spec 305, and standard spec 310 as modified here in this special provision. Apply this special provision to material placed under all of the Base Aggregate Dense and Base Aggregate Open Graded bid items, except do not apply this special provision to material classified as reclaimed asphaltic pavement placed under the Base Aggregate Dense bid items.
- (3) Do not apply this special provision to material placed under the Aggregate Detours, Salvaged Asphaltic Pavement Base, Breaker Run, Select Crushed, Pit Run, Subbase, or Riprap bid items.
- (4) Provide and maintain a quality control program, defined as all activities related to and documentation of the following:
 1. Production and placement control and inspection.
 2. Material sampling and testing.
- (5) Chapter 8 of the department's construction and materials manual (CMM) provides additional detailed guidance for QMP work and describes required sampling and testing procedures. The contractor may obtain the CMM from the department's web site at:

<http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/rdwy/default.aspx>

A.2 Contractor Testing for Small Quantities

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

2. Divide the aggregate into uniformly sized sublots for testing as follows:

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

- ^[1] If using production tests for acceptance, submit test results to the engineer for review prior to incorporating the material into the work. Production test results are valid for a period of 3 years.
- ^[2] For 3-inch material, obtain samples at load-out.
- ^[3] If the actual quantity overruns 9000 tons, create overrun sublots to test at a rate of one additional placement test for each 3000 tons, or fraction of 3000 tons, of overrun.
3. No control charts are required. Submit aggregate load-out and placement test results to the engineer within one business day of obtaining the sample. Assure that all properties are within the limits specified for each test.
4. Department verification testing is optional for quantities of 6000 tons or less.
- (3) Material represented by a subplot with any property outside the specification limits is nonconforming. The department may reject material or otherwise determine the final disposition of nonconforming material as specified in standard spec 106.5.

B Materials

B.1 Quality Control Plan

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

6. Locations of the QC laboratory, retained sample storage, and where control charts and other documentation is posted.
7. An outline for resolving a process control problem. Include responsible personnel, required documentation, and appropriate communication steps.

B.2 Personnel

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

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

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

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

B.3 Laboratory

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

Materials Management Section
3502 Kinsman Blvd.
Madison, WI 53704
Telephone: (608) 246-5388

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

B.4 Quality Control Documentation

B.4.1 General

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

B.4.2 Records

- (1) Document all placement observations, inspection records, and control adjustments daily in a permanent field record. Also include all test results in the project records. Provide test results to the engineer within 6 hours after obtaining a sample. For 3-inch

base, extend this 6-hour limit to 24 hours. Post or distribute tabulated results using a method mutually agreeable to the engineer and contractor.

B.4.3 Control Charts

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

B.5 Contractor Testing

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

- (6) Test the liquid limit and plasticity index for the first gradation test. Subsequently, test the liquid limit and plasticity index a minimum of once per 10 gradation tests.

B.6 Test Methods

B.6.1 Gradation

- (1) Test gradation using a washed analysis conforming to the following as modified in CMM 8.60:
Gradation..... AASHTO T 27
Material finer than the No. 200 sieve..... AASHTO T 11
- (2) For 3-inch base, if 3 consecutive running average points for the percent passing the No. 200 sieve are 8.5 percent or less, the contractor may use an unwashed analysis. Wash at least one sample out of 10. If a single running average for the percent passing the No. 200 sieve exceeds 8.5 percent, resume washed analyses until 3 consecutive running average points are again 8.5 percent passing or less.
- (3) Maintain a separate control chart for each sieve size specified in standard spec 305 or standard spec 310 for each base aggregate size, source or classification, and type. Set control and warning limits based on the standard specification gradation limits as follows:
 1. Control limits are at the upper and lower specification limits.
 2. There are no upper warning limits for sieves allowing 100 percent passing and no lower control limits for sieves allowing 0 percent passing.
 3. Dense graded warning limits, except for the No. 200 sieve, are 2 percent within the upper and lower control limits. Warning limits for the No. 200 sieve are set 0.5 percent within the upper and lower control limits.
 4. Open graded warning limits for the 1-inch, 3/8-inch, and No. 4 sieves are 2 percent within the upper and lower control limits. Upper warning limits for the No. 10, No. 40, and No. 200 sieves are 1 percent inside the upper control limit.

B.6.2 Fracture

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

B.6.3 Liquid Limit and Plasticity

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

B.7 Corrective Action

B.7.1 General

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

B.7.2 Placement Corrective Action

- (1) Do not blend additional material on the roadbed to correct gradation problems.
- (2) Notify the engineer whenever the running average exceeds a warning limit. When two consecutive running averages exceed a warning limit, the engineer and contractor will discuss appropriate corrective action. Perform the engineer's recommended corrective action and increase the testing frequency as follows:
 1. For gradation, increase the QC testing frequency to at least one randomly sampled test per 1000 tons placed.
 2. For fracture, increase the QC testing frequency to at least one test per gradation test.
- (3) If corrective action improves the property in question such that the running average after 4 additional tests is within the warning limits, the contractor may return to the testing frequency specified in B.5.3. If corrective action does not improve the property in question such that the running average after 4 additional individual tests is still in the warning band, repeat the steps outlined above starting with engineer notification.
- (4) If the running average exceeds a control limit, material starting from the first running average exceeding the control limit and ending at the first subsequent running average inside the control limit is nonconforming and subject to pay reduction.
- (5) For individual test results significantly outside the control limits, notify the engineer, stop placing base, and suspend other activities that may affect the area in question. The engineer and contractor will jointly review data, data reduction, and data analysis; evaluate sampling and testing procedures; and perform additional testing as required to determine the extent of potentially unacceptable material. The engineer may direct the contractor to remove and replace that material. Individual test results are significantly outside the control limits if meeting one or more of the following criteria:
 1. A gradation control limit for the No. 200 sieve is exceeded by more than 3.0 percent.
 2. A gradation control limit for any sieve, except the No. 200, is exceeded by more than 5.0 percent.
 3. The fracture control limit is exceeded by more than 10.0 percent.

B.8 Department Testing

B.8.1 General

- (1) The department will conduct verification testing to validate the quality of the product and independent assurance testing to evaluate the sampling and testing. The

department will provide the contractor with a listing of names and telephone numbers of all QV and IA personnel for the project, and provide test results to the contractor within two business days after the department obtains the sample.

B.8.2 Verification Testing

B.8.2.1 General

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

B.8.3 Independent Assurance

- (1) Independence assurance is unbiased testing the department performs to evaluate the department's QV and the contractor's QC sampling and testing including personnel qualifications, procedures, and equipment. The department will perform an IA review according to the department's independent assurance program. That review may include one or more of the following:
 1. Split sample testing.
 2. Proficiency sample testing.
 3. Witnessing sampling and testing.
 4. Test equipment calibration checks.
 5. Reviewing required worksheets and control charts.
 6. Requesting that testing personnel perform additional sampling and testing.

- (2) If the department identifies a deficiency, and after further investigation confirms it, correct that deficiency. If the contractor does not correct or fails to cooperate in resolving identified deficiencies, the engineer may suspend placement until action is taken. Resolve disputes as specified in B.9.

B.9 Dispute Resolution

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

C (Vacant)

D (Vacant)

E Payment

- (1) Costs for all sampling, testing, and documentation required under this special provision are incidental to this work. If the contractor fails to perform the work required under this special provision, the department may reduce the contractor's pay. The department will administer pay reduction under the non-performance of QMP administrative item.
- (2) For material represented by a running average exceeding a control limit, the department will reduce pay by 10 percent of the contract price for the affected Base Aggregate bid items listed in subsection A. The department will administer pay reduction under the Nonconforming QMP Base Aggregate Gradation or Nonconforming QMP Base Aggregate Fracture Administrative items. The department will determine the quantity of nonconforming material as specified in B.7.2.

301-010 (20151210)

16. HMA Pavement 3 LT 58-28 S, Item 460.5223; HMA Pavement 4 LT 58-28 S, Item 460.5224.

A Description

This special provision describes providing HMA pavement including the binder under a combined bid item.

Define gradations, traffic levels, and asphaltic binder designation levels as follows:

<u>GRADATIONS (NMAS)</u>	<u>TRAFFIC VOLUME</u>	<u>DESIGNATION LEVEL</u>
1 37.5 mm	LT Low	S Standard
2 25.0 mm	MT Medium	H Heavy
3 19.0 mm	HT High	V Very Heavy
4 12.5 mm		E Extremely Heavy
5 9.5 mm		
6 4.75 mm		

Construct HMA pavement of the type the bid item indicates encoded as follows:



Conform to standard spec 460 as modified in this special provision.

B Materials

Replace standard spec table 460-1 with the following to change the footnotes to refer to LT and MT mixes instead of E-0.3 and E-3 mixes:

**TABLE 460-1 AGGREGATE GRADATION
MASTER RANGE AND VMA REQUIREMENTS**

SIEVE	PERCENTS PASSING DESIGNATED SIEVES						
	NOMINAL SIZE						
	37.5 mm (#1)	25.0 mm (#2)	19.0 mm (#3)	12.5 mm (#4)	9.5 mm (#5)	SMA 12.5 mm (#4)	SMA 9.5 mm (#5)
50.0-mm	100						
37.5-mm	90 – 100	100					
25.0-mm	90 max	90 - 100	100				
19.0-mm	___	90 max	90 - 100	100		100	
12.5-mm	___	___	90 max	90 - 100	100	90 - 97	100
9.5-mm	___	___	___	90 max	90 - 100	58 - 72	90 - 100
4.75-mm	___	___	___	___	90 max	25 - 35	35 - 45
2.36-mm	15 – 41	19 - 45	23 - 49	28 - 58	20 - 65	15 - 25	18 - 28
75-µm	0 – 6.0	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0	8.0 - 12.0	10.0 - 14.0
% MINIMUM VMA	11.0	12.0	13.0	14.0 ^[1]	15.0 ^[2]	16.0	17.0

^[1] 14.5 for LT and MT mixes

^[2] 15.5 for LT and MT mixes

Replace standard spec table 460-2 with the following to switch from E mixes to LT, MT, and HT mixes; and change the tensile strength ratio requirements to 0.75 without antistripping additive and 0.80 with antistripping additive:

TABLE 460-2 MIXTURE REQUIREMENTS

Mixture type	LT	MT	HT	SMA
ESALs x 10 ⁶ (20 yr design life)	<2.0	2 - <8	>8	> 5 mil
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 5821) (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] [4]	65 - 75 ^[3] [4]	70 - 80

Mixture type	LT	MT	HT	SMA
Tensile Strength Ratio (TSR) (ASTM 4867)				
no antistripping additive	0.75	0.75	0.75	0.75
with antistripping additive	0.80	0.80	0.80	0.80
Draindown at Production Temperature (%)	—	—	—	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 MP3), the dust to binder ratio limits are 0.6 - 1.6.

^[3] For #5 (9.5mm) and #4 (12.5 mm) nominal maximum size mixtures, the specified VFB range is 70 - 76%.

^[4] For #2 (25.0mm) nominal maximum size mixes, the specified VFB lower limit is 67%.

^[5] For #1 (37.5mm) nominal maximum size mixes, the specified VFB lower limit is 67%.

Replace standard spec 460.2.8.2.1.7 paragraph six with the following to base payment adjustment on the combined bid item unit price:

(6) The department will reduce payment for nonconforming QMP HMA mixtures, starting from the stop point to the point when the running average is back inside the warning limits, as follows:

PAYMENT FOR MIXTURE^{[1] [2]}

ITEM	PRODUCED WITHIN WARNING BANDS	PRODUCED OUTSIDE JMF LIMITS
Gradation	90%	75%
Asphalt Content	85%	75%
Air Voids	70%	50%
VMA	90%	75%

^[1] For projects or plants where the total production of each mixture design requires less than 4 tests refer to CMM 8-36.

^[2] Payment is in percent of the contract unit price for the HMA Pavement bid item. The department will reduce pay based on the nonconforming property with lowest percent pay. The department will administer pay reduction under the Nonconforming QMP HMA Mixture administrative item.

Replace standard spec 465.2 with the following:

⁽¹⁾ Under the Asphaltic Surface, Asphaltic Surface Detours, and Asphaltic Surface Patching bid items; submit a mix design. Furnish asphaltic mixture meeting the requirements specified for either type LT or MT mix under standard spec 460.2; except the engineer will

not require the contractor to conform to the quality management program specified under standard spec 460.2.8.

(2) Under the other 465 bid items, the contractor need not submit a mix design. Furnish aggregates mixed with a type AC asphaltic material. Use coarse and fine mineral aggregates uniformly coated and mixed with the asphaltic material in an engineer-approved mixing plant. The contractor may include reclaimed asphaltic pavement materials in the mixture.

C Construction

Replace standard spec table 460-3 with the following to switch from E mixes to LT, MT, and HT mixes:

TABLE 460-3 MINIMUM REQUIRED DENSITY^[1]

LOCATION	LAYER	PERCENT OF TARGET MAXIMUM DENSITY		
		MIXTURE TYPE		
		LT and MT	HT	SMA ^[5]
TRAFFIC LANES ^[2]	LOWER	91.5 ^[3]	92.0 ^[4]	_____
	UPPER	91.5	92.0	_____
SIDE ROADS, CROSSOVERS, TURN LANES, & RAMPS	LOWER	91.5 ^[3]	92.0 ^[4]	_____
	UPPER	91.5	92.0	_____
SHOULDERS & APPURTENANCES	LOWER	89.5	89.5	_____
	UPPER	90.5	90.5	_____

^[1] The table values are for average lot density. If any individual density test result falls more than 3.0 percent below the minimum required target maximum density, the engineer may investigate the acceptability of that material.

^[2] Includes parking lanes as determined by the engineer.

^[3] Minimum reduced by 2.0 percent for a lower layer constructed directly on crushed aggregate or recycled base courses.

^[4] Minimum reduced by 1.0 percent for a lower layer constructed directly on crushed aggregate or recycled base courses.

^[5] The minimum required densities for SMA mixtures are determined according to CMM 8-15.

D Measurement

Add the following to standard spec 460.4:

The department will measure HMA Pavement (type) conforming to standard spec 460.4.

E Payment

Add the following to standard spec 460.5 to switch from E mixes to LT, MT, and HT mixes; to combine the pavement and binder bid items; and to specify a pay reduction for pavement placed with nonconforming binder:

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

ITEM NUMBER	DESCRIPTION	UNIT
460.5223	HMA Pavement 3 LT 58-28 S	TON
460.5224	HMA Pavement 4 LT 58-28 S	TON
460.6223	HMA Pavement 3 MT 58-28 S	TON
460.6224	HMA Pavement 4 MT 58-28 S	TON

Payment is full compensation for providing HMA Pavement including asphaltic binder.

In addition to any pay adjustment under standard spec 460.2.8.2.1.7(6), the department will adjust pay for nonconforming binder under the Nonconforming QMP Asphaltic Material administrative item. The department will deduct 25 percent of the contract unit price of the HMA Pavement bid item per ton of pavement placed with nonconforming PG binder the engineer allows to remain in place.

460-025 (20160419)

17. Stone or Rock Ditch Checks, Item 628.7515.S.

A Description

This special provision describes furnishing and installing stone or rock ditch checks as shown on the plans or as directed by the engineer, or both, and as hereinafter provided.

B Materials

Provide materials conforming to size requirements for size no. 2 coarse aggregate for concrete masonry or riprap in accordance to the standard spec 501.2.5.4.4. Railroad ballast or breaker run stone conforming to the following applicable gradations may also be used:

Railroad Ballast	
Percent by	
Sieve Size	Weight Passing
2 Inch	100
1 Inch	20 – 55
3/8 Inch	0 -5

Breaker Run Stone	
Percent by	
Sieve Size	Weight Passing
5 Inch	100
1 1/2 Inch	0 – 50
3/8 Inch	0 - 5

Incorporate stone or rock in the ditch checks that is hard, sound, and durable, and meets the approval of the engineer.

C Construction

Place stone or rock ditch checks immediately after shaping of the ditches or slopes is completed. Place stone or rock ditch checks at right angles to the direction of flow and construct to the dimensions and in accordance to the details shown in the plans.

Remove sediment from behind the stone or rock ditch checks when it has accumulated to one half of the original height of the dam.

D Measurement

The department will measure Stone or Rock Ditch Checks in volume by the cubic yard of material incorporated in the work.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
628.7515.S	Stone or Rock Ditch Checks	CY

Payment is full compensation for furnishing, producing, crushing, loading, hauling, placing, and shaping and maintaining Stone or Rock Ditch Check.

The quantity of sediment removed shall be multiplied by a factor of ten and paid for as Common Excavation.

628-050 (20151210)

18. Furnishing and Planting Plant Materials.

Amend standard spec 632 as follows:

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

- A. This section includes the following:
 - 1. Trees
 - 2. Shrubs
 - 3. Perennials
 - 4. Topsoil and soil amendments

5. Mineral and organic mulches
6. Edging

1.3 QUALITY ASSURANCE

- A. Landscape work shall be done by a single firm specializing in landscape work.
- B. Source Quality Control:
 1. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to the engineer, together with proposal for use of equivalent material.
- C. Trees, Shrubs and Plants: Provide freshly dug trees and shrubs. Do not prune prior to delivery unless otherwise approved by the engineer. Do not bend or bind-tie in such manner as to damage bark, break branches, or destroy natural shape. Handle balled and burlapped stock by the root ball only. Do not drop balled and burlapped stock during delivery. No balled and burlapped plant shall be planted if the ball is cracked or broken, unless approved by the engineer.
 1. Spray anti-desiccant on deciduous trees and shrubs just prior to transport.
 2. Provide protective covering during delivery.
 3. Deliver trees, shrubs, and plants after preparations for planting have been completed and plant immediately. In healing in, all bundles must be opened and the plants separated before the roots are covered, and care shall be taken that no air pockets remain among the roots.
 4. Do not remove container-grown stock from containers until planting time.
 5. If planting is delayed more than 6 hours after delivery, set plants in shade, protect from weather and mechanical damage, and keep roots moist with mulch covering, burlap or other acceptable means of retaining moisture.
 6. Water root systems of trees, shrubs and plants stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.4 PROJECT CONDITIONS

- A. Existing Conditions: Contractor shall be held to have visited the site, be familiar with the existing conditions and made due allowance for them in a proposal.
- B. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- C. Detrimental Conditions: When conditions detrimental to plant, seed, or sod growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify the engineer before attempting to plant.

1.5 SEQUENCING AND SCHEDULING

- A. Plant or install materials during normal planting seasons for each type of material required or as approved by the engineer.
- B. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.
- C. Plant shrubs after final grades are established and prior to seeding or sodding unless otherwise acceptable to the engineer. If planting of shrubs occurs after seeding or sodding, contractor shall be responsible for protection of these areas and for promptly repairing any damage caused by planting operations.

PART 2 - PRODUCTS

2.1 FURNISHING AND PLANTING PLANT MATERIALS.

The work under this item shall be according to the plans, standard spec 632 and as hereinafter provided.

- A. Materials.
 - 1. Plant Materials. All plants shall be grown within the State of Wisconsin, Iowa, or Illinois located within zone 4 or 5 of the United States Department of Agriculture Plant Hardiness Zone Map”, most recent revision, unless otherwise approved by the engineer. A list of sources for plants shall be furnished according to standard spec 632.2.2.8 before planting begins for fall planted plants and before March 15, of the following year for spring planted plants. All sources will be subject to verification by the engineer.
 - 2. Fertilizer for Plant Holes. The first paragraph of standard spec 632.2.4.2 shall be amended to require the amount of fertilizer in each packet be a minimum of 2 ounces with a slow-time release period of 3 years.
 - 3. Mineral Mulch: Red granite chips. Crushed Red Granite Chips, size range 1-1/2" maximum, 3/4" minimum and natural central Wisconsin granite red color range.
 - 4. Rodent Protection. Rodent protection for tall-growing trees shall be a minimum 4-foot long double layer of commercial screening wire mesh sheet acceptable to the engineer and installed as shown on the Planting Detail Sheet and described in these special provisions.
 - 5. Polyethylene Edging at stone mulch areas only: Valley View Black Edge-Knight edging or equivalent. Height 5-inches, straight top, with manufacturer’s standard stakes.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS.

- A. Plant Bed Preparation. Planting Layout: Standard spec 632.3.3 shall be amended as follows: Contractor shall lay out individual tree and shrub locations for multiple plantings by lath staking or flagging. Secure engineer's approval before planting. Make minor adjustments as may be required.
- B. Excavation of Plant Holes. Standard spec 632.3.4 is revised as follows: The minimum horizontal measurement of the plant hole shall not be less than 24 inches (600 mm) greater than the diameter of the mass for the full depth of the planting hole. Excavation of plant holes to be accomplished by hand methods.
- C. The bottom of the planting hole shall be undisturbed. The bottom of the rootball shall be in direct contact with the bottom of the hole. No extra fill shall be added to the bottom of the hole.
- D. Pruning. Standard spec 632.3.5 shall be supplemented with the following: All pruning shall be done according to American National Standards Institute publication ANSI A300-1995, "Tree, Shrub and Other Woody Plant Maintenance – Standard Practices". Pruning shall be done according to standard spec 632.3.5 with the following exceptions: "Flush with the trunk or branch" is clarified to mean that the bark ridge and branch collar shall be left intact, and the pruning cut shall be made immediately above the bark ridge and branch collar
- E. Planting. Planting shall follow the procedure contained in standard spec 632.3.7 through 632.3.17. Except standard spec 632.3.7 shall be amended as follows: Tree and shrub plant holes shall be backfilled with a three-to-one (3:1) mixture of topsoil to peat humus compost. Soil shall also be amended to maintain a pH level of between 6.5 and 7.4; 2.
- F. Red granite chips bedding. Granite material shall be placed In the area around the individual plants and within the entire area indicated as "planting bed limits" on the landscaping details within 5 days of the second watering required under planting. Areas to be mulched shall be free of living weeds and grasses before mulch is applied.
- G. Rodent Protection. Rodent protection shall be applied to those plants indicated on the Plant Data Chart of the plan according to standard spec 632.3.13. The rodent protection material shall be placed around each tree trunk with the bottom of the material resting on the soil surface and the top a minimum of 48 inches above the surrounding earth surface, or to the lowest branches of small trees. The rodent protector shall be wrapped loosely around the tree trunk and stapled to itself at maximum 6-inch intervals along the seam.

3.2 PLANT ESTABLISHMENT AND REPLACEMENT.

- A. Plant Establishment Period. A two-year plant establishment period is required according to standard spec 632.3.19.1.

19. Landscape Planting Surveillance and Care Cycles.

If the care specialist fails to perform any of the required care cycles as specified in standard spec 632.3.19.1, the department will assess daily damages in the amount of \$500 to cover the cost of performing the work with other forces. The department will assess these damages for each day the requirements of the care cycle remain incomplete, except when the engineer extends the required time period.

632-005 (20070510)

20. General Requirements for Electrical Work.

Amend standard spec 651.2, Materials, by adding the following paragraphs:

- (7) The approved products list is located at:
<http://www.dot.wisconsin.gov/business/engrserv/docs/ap4/electrical.pdf>

21. Install Conduit Into Existing Item, Item 652.0700.S.

A Description

This special provision describes installing proposed conduit into an existing manhole, pull box, junction box, communication vault, or other structure.

B Materials

Use Conduit HDPE Directional Bore 2 Duct 2-Inch, as provided and paid for under other items in this contract. Furnish backfill material, topsoil, fertilizer, seed, and mulch conforming to the requirements of pertinent provisions of the standard specifications.

C Construction

Expose the outside of the existing structure without disturbing existing conduits or cabling. Drill the appropriate sized hole for the entering conduit(s) at a location within the structure without disturbing the existing cabling and without hindering the installation of new cabling within the installed conduit. Fill void area between the drilled hole and conduit with an engineer-approved filling material to protect against conduit movement and entry of fill material into the structure. Tamp backfill into place.

D Measurement

The department will measure Install Conduit Into Existing System by the unit, acceptably installed. Up to five conduits entering a structure per entry point into the existing structure will be considered a single unit. Conduits in excess of five, or conduits entering at significantly different entry points into the existing pull box, manhole, or junction box will constitute multiple units of payment.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
652.0700.S	Install Conduit Into Existing Item	Each

Payment is full compensation for excavating, drilling holes; furnishing and installing all materials, including bricks, coarse aggregate, sand, bedding, and backfill; for excavating and backfilling; and for furnishing and placing topsoil, fertilizer, seed, and mulch in disturbed areas; for properly disposing of surplus materials; and for making inspections.
652-070 (20100709)

22. Electrical Service Meter Breaker Pedestal (CB 100), Item 656.0200.001.

This work shall be according to the requirements of section 656, the plans, standard detail drawings, and as hereinafter provided.

Amend standard spec 656.3.2, Service Lateral, paragraph (1) to read as follows:

- (1) The local utility shall furnish and install a 200 A, 120/240 volt AC, single phase, 3-wire underground electrical service lateral. Arrange and assume responsibility for the timely installation of the service lateral by the utility. The lateral shall be terminated at a meter pedestal as the plans show.

23. Luminaires High Mast Lighting, Item 659.0400.

This article describes modifications to chapter 659 of the standard specifications.

Replace standard spec 659.2, Materials, to read as follows:

- (1) Furnish high mast luminaires from manufacturers as specified on the department's approved products list. Furnish Holophane LED model HMLED2-12-4K-AN or approved equal from the list of approved high mast luminaire manufacturers.

24. Lighting Units Walkway, Item 659.0700.

This article describes modifications to chapter 659 of the standard specifications.

Replace standard spec 659.2, Materials, to read as follows:

- (1) Furnish walkway luminaires from the manufacturer as specified on the department's approved products list. Furnish American Electric Lighting LED model 245L-10LEDE10-4K-R3-RNA.

25. Remove Street Light, Item SPV.0060.001.

A Description

This special provision describes removing and salvaging an existing base mounted light pole, transformer bases, arm(s) and luminaire(s).

B (Vacant)

C Construction

Contact the appropriate personnel at least 7 days prior to removing any street lights on the WisDOT lighting systems. Arrange a meeting to document the existing condition of all street lighting materials that will be affected by construction activities. WisDOT will provide the following information:

Identify all items to be salvaged or disposed

Identify existing feed-point locations and circuit breaks.

When removing existing street lights, carefully remove and stockpile all equipment at a location approved by the engineer. Place all equipment on blocks so as not to be in direct contact with the ground. Protect luminaires from moisture. Make lights available for pick up and salvage. Properly dispose of any equipment that is not salvaged.

Replace any equipment damaged in the removal process with equipment that is of greater or equal quality than the damaged piece.

D Measurement

The department will measure Remove Street Light 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
SPV.0060.001	Remove Street Light	Each

Payment is full compensation for removals, salvage, delivery, stockpile and/or disposal as required above.

26. Pull Box Non-Conductive 24x42-Inch, Item SPV.0060.002.

A Description

This special provision describes furnishing and installing Pull Box Non-Conductive (size) shown on the plans.

B Materials

Furnish pull boxes, frames, and lids made of non-conductive material. Pull boxes, frames, and lids shall be suitable for Tier 15 loading as specified in ANSI/SCTE 77.

C Construction

Provide pull boxes, frames, and lids made of non-conductive materials. The contractor may extend Pull Box Non-Conductive (size) as the plan details show using the same material as the pull box. Saw extensions parallel to the extension ring. Secure extension to original box as shown in the plan details. Excavate, place coarse aggregate drain material, and backfill as the plan details show. Dispose of surplus or unsuitable materials as specified under standard spec 205.3.12. Use covers stamped with "Electric" for traffic signal and lighting pull boxes or "WISDOT COMMUNICATIONS" for communications pull boxes.

Provide one 24" length of #6 reinforcing steel to be driven vertically on the north side of the pull box.

D Measurement

The department will measure Pull Box Non-Conductive 24x42-Inch as each individual unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.002	Pull Box Non-Conductive 24x42-Inch	Each

Payment for Pull Box Non-Conductive (size) is full compensation for providing and installing pull boxes, frames, lids, aggregate, fasteners, reinforcing steel; conduit extensions less than 10 feet long including fittings; and for all excavating, backfilling and disposing of surplus material. The department will pay separately for engineer-directed pull box drain duct under the Conduit Rigid Nonmetallic bid items as specified in standard spec 652.5.

27. Underground LP Tanks and Piping, Item SPV.0060.101.

A Description.

This special provision describes furnishing, installing, and filling underground liquefied petroleum (L.P.) gas tanks and furnishing and installing L.P. gas piping as shown on the plans and as hereinafter provided.

L.P. gas tanks, piping, and appurtenances shall meet the requirements as set forth in the Wisconsin Administrative Code, Chapter ILHR 11, Liquefied Petroleum Gas.

B Materials

Furnish steel LP gas tanks with a 1000-gallon water capacity. Equip tanks with the standard required outlets for all connections, lifting lugs, float gage, relief valve, valve outlet with filter, vapor equalizer, and regulator opening with a pressure regulator. Tanks shall have an approved steel manhole and cover sufficient in size to enclose all necessary regulators, relief valves, and fittings.

Tanks shall have a corrosion protection system designed by tank fabricator. Corrosion protection system shall include magnesium anodes with terminal test box located in manhole, insulated fittings to isolate tank from piping to building, and a protective coating applied to the tank. Protective coating shall be equivalent to hot-dip galvanizing or 10-mils dry film thickness of polyamide epoxy paint.

A Certificate of Compliance for tanks shall be submitted to engineer in triplicate before installation is permitted.

Piping shall be black steel, Schedule 40, ASTM A53, with plastic coating complying with requirements of the American Gas Association (AGA).

Fittings shall be black steel welding fittings, ANSI B16.9, standard weight. Joints shall be welded and wrapped in accordance to requirements of AGA.

C Construction

Locate tank a minimum of 25 feet from building, and as directed by the engineer. Place tank not less than two feet below the finished ground surface. Excavation for tank shall be of sufficient depth, length and width to provide for the placement of 6 inches of sand below and a minimum of 12 inches of sand on either side and both ends of tank. Sand backfill shall be carefully tamped in place, so that the backfill in excavated area shall have a compacted density at least equal to the density of the surrounding soils.

Upon completion of installation and before filling with L.P. gas, tank shall be thoroughly purged of moisture by using alcohol.

Install underground piping so as to provide gravity drainage back to tanks.

Backfill the gas piping in accordance to standard spec 607.3.5 except as hereinafter modified. The gas pipe shall be laid in a 12-inch envelope of sand backfill, the remainder of the trench shall be backfilled with the excavated material.

D Measurement

The department will measure Underground LP Tanks and Piping by each individual unit in place and filled with fuel, acceptably completed. The piping included as part of this item shall extend from tank to (but not including) the pressure regulator on the outside of SWEF building.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.101	Underground LP Tanks and Piping	Each

Payment is full compensation for furnishing and installing the tank; for filling the tank with fuel; for furnishing and installing all connections, controls, piping; for excavating and backfilling and incidentals necessary to complete the work.

28. Trash Receptacles, Item SPV.0060.102.

A Description

This special provision describes furnishing and installing trash receptacles, complete and in place, at the locations as designated on the plans or as directed by the engineer.

B Materials

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

Acceptable manufacturers are listed below.

1. Pre-Terra Products
P.O. Box 1520
Wausau, WI 54402-1520
(800) 388-8728
2. Environmental Features, Inc.
3. Quick Crete Products
4. Approved equal.

C Construction

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

D Measurement

The department will measure Trash Receptacles as each individual unit in place 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.0060.102	Trash Receptacles	Each

Payment is full compensation for furnishing, hauling and installing trash receptacles.

29. Construction Staking Fence, Item SPV.0090.001.

A Description

This work shall consist of construction staking for fencing including posts.

B (Vacant)

C Construction

Construction stakes for fencing system shall be set and maintained as necessary to achieve the required accuracy and to satisfy the contractor's method of operations. All post construction stakes shall be located to within 0.02 feet of the true horizontal position.

D Measurement

The department will measure Construction Staking Fence by the linear foot, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.001	Construction Staking Fence	LF

Payment is full compensation for survey work necessary to locate and set all fence post construction stakes, for relocating and resetting construction stakes, for furnishing all labor, tools, stakes, lath, flags, equipment and incidentals necessary to complete the work.

30. Concrete Curb and Gutter 24-Inch Type A Special, Item SPV.0090.002; Concrete Curb and Gutter 24-Inch Type D Special, Item SPV.0090.003.

Construct concrete curb and gutter as shown in the plans, and in accordance to standard spec 601.

31. Fiber Optic Tracer Cable, Item SPV.0090.004.

A Description

This special provision describes furnishing and installing fiber optic tracer cable in all conduit containing fiber optic cable.

B Materials

Provide the tracer cable with a black insulation cover, No. 14 AWG, XLP, USE rated, 600 VAC, single conductor, copper wire.

C Construction

Install the tracer cable in all conduit containing fiber optic cable, running continuously through all pull boxes. Install the tracer cable to each control cabinet, but do not enter the cabinet. The tracer cable may be spliced only in pull boxes. Make splices only between full rolls of wire. For the cable splice use a Western Union Splice soldered with resin core flux. All exposed surfaces of the solder shall be smooth. Solder splices using a soldering iron. Cover the splice with a WCSMW 30/100 heat shrink tube, minimum length 4-inches, and with a minimum one-inch coverage over the XLP insulation, underwater grade.

D Measurement

The department will measure Fiber Optic Tracer Cable in length by the linear foot of cable, measured along the centerline of the conduit.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.004	Fiber Optic Tracer Cable	LF

Payment is full compensation for furnishing and installing the tracer cable; splicing; properly disposing of surplus materials; and for furnishing all labor, tools, equipment and incidentals necessary to complete the contract work.

32. Fence Chain Link 6-FT Special, Item SPV.0090.005.**A Description**

This special provision describes furnishing and installing Fence Chain Link 6-FT Special as shown on the plans.

B Materials

Conform to standard spec 616.2 except supplement standard spec 616.2.3.3 with the following:

Furnish a top rail in lieu of tension wire.

C Construction

Conform to standard spec 616.3.3 except replace standard spec 616.3.3.1 with the following:

Erect chain link fencing fabric, of the required height, attached at the top with a top rail and bottom with a tension wire, on driven unbraced metal line posts.

D Measurement

The department will measure Fence Chain Link 6-FT Special by linear foot, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.005	Fence Chain Link 6-FT Special	LF

Payment for Fence Chain Link 6-FT Special is full compensation for clearing and grubbing the fence line; for excavating; for setting posts including placing concrete; for erecting and tensioning all fencing components; for installing grounds; and for removing and disposing of all debris, excess excavation, and surplus materials.

33. Telephone Service, Sparta SWEF, Item SPV.0105.001.

A Description

This work consists of all coordination, work by utility, and work by contractor as required to provide underground telephone service to new SWEF Building.

Non-metallic conduit required for crossing under paved areas is included under other bid items.

B (Vacant)

C Construction

Contractor makes all arrangements and coordinates telephone utility work with CenturyLink.

Utility provides telephone service to the project SWEF building network interface device.

Contractor includes all other work not completed by CenturyLink but necessary for complete installation.

D Measurement

The department will measure Telephone Service, Sparta SWEF as a single lump sum unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.001	Telephone Service, Sparta SWEF	LS

Payment is full compensation for providing and coordinating underground telephone service to new SWEF Building, furnishing and installing telephone cable, pedestals and network interface devices, and associated coordination, labor, material, equipment, tools, and incidentals necessary to complete the work.

34. Electrical Service, Sparta SWEF, Item SPV.0105.002.

A Description

This work consists of all coordination, work by utility, and work by contractor as required to provide electrical service from an existing source(s) to a transformer(s) for the new Sparta SWEF Building location, mainline weigh-in-motion location, and virtual weigh station location, in accordance with the plans and as hereinafter provided. Electrical service shall include underground three-phase power to transformers near the proposed building location, single-phase power to mainline weigh-in-motion location along IH 90, and single-phase power to virtual weigh station location along STH 16, including furnishing and installation of transformers and transformer pads; underground service to

the new SWEF building, mainline weigh-in-motion location, and virtual weigh station location; wire and terminations at transformers and at meter sockets; and meters.

Site lighting; site telephone/internet/network service, and telephone wiring and equipment within the SWEF Building; electrical work and equipment from the meter socket, conduit, and electrical system terminations at the main switch(s); and exterior conduit stub from the meter are included under other bid items.

Non-metallic conduit required for crossing under paved areas is included under other bid items.

B (Vacant)

C Construction

Contractor makes all arrangements and coordinates electric utility service work with Xcel Energy.

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

The electric utility company (Xcel Energy) charges will be paid for separately by the department.

Contractor includes all other work not completed by Xcel Energy but necessary for complete installation.

D Measurement

The department will measure Electrical Service, Sparta SWEF as a single lump sum unit of work, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.002	Electrical Service, Sparta SWEF	LS

Payment is full compensation for providing and coordinating overhead and/or underground electric service from existing source to the transformer(s) at the proposed locations, to the SWEF building, to the mainline weigh-in-motion location, and to the virtual weigh station location, transformers, transformer pads, meter; and all associated coordination, labor, material, equipment, tools, and incidentals necessary to complete the work.

35. Natural Gas Service, Sparta SWEF, Item SPV.0105.003.

A Description

This work consists of all coordination, work by utility, and work by contractor as required to provide underground natural gas service to new SWEF Building.

B (Vacant)

C Construction

Contractor makes all arrangements and coordinates natural gas utility work with WE Energies.

Utility provides natural gas service to the project SWEF building meter location.

The natural gas utility company (WE Energies) charges shall be paid for separately by the department.

Contractor includes all other work not completed by WE Energies but necessary for complete installation.

D Measurement

The department will measure Natural Gas Service, Sparta SWEF as a single lump sum unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.003	Natural Gas Service, Sparta SWEF	LS

Payment is full compensation for providing and coordinating underground natural gas service to new SWEF Building, furnishing and installing system, and associated coordination, 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.

36. Construction Staking Initial Layout Parking Lot, SPV.0105.004.

A Description

This work shall consist of contractor performed construction staking required of the initial layout for the parking lot.

B (Vacant)

C Construction

Set and maintain construction stakes or marks to achieve the required accuracy and to support the method of operations. Check the department provided horizontal and vertical control information. Provide stakes to establish and maintain intermediate vertical and horizontal control for reference line alignment, radius points, and slopes on the ground, running bench level circuits and offsetting the horizontal roadway alignment. These stakes and markings constitute the field control used to govern and execute the work.

Verify the existing ground elevations as shown for all roadways on cross section sheets for accuracy. Take and document a minimum of 3 shots per roadway section. Set and maintain slope stakes on each side of the road at each cross section location the plans show.

Document and provide complete descriptions and reference ties of the control points, alignment points, and benchmarks to the engineer to allow for quick reestablishment of the plan data at any time during construction and upon project completion.

Protect and reestablish all roadway alignment affected by the plan, or as the engineer directs.

D Measurement

The department will measure Construction Staking Initial Layout Parking Lot as a lump sum unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.004	Construction Staking Initial Layout Parking Lot	LS

Payment is full compensation for locating and setting all construction stakes; for resetting damaged or missing preliminary construction stakes, for protecting and reestablishing the alignments and for setting and checking slope stakes, and for furnishing all labor, tools, stakes, lath, flags, equipment and incidentals necessary to complete the work.

37. Construction Staking Subgrade Parking Lot, SPV.0105.005.

A Description

This work shall consist of contractor performed construction staking required of the subgrade for the parking lot.

B (Vacant)

C Construction

Set construction stakes or marks at a minimum of 50-foot intervals including additional stakes each cross section to match the plan cross section as necessary to achieve the required accuracy, and support the method of operations. Also, set and maintain stakes as necessary to establish horizontal and vertical position for intersecting road radii, horizontal and vertical curves, and curve transitions. Locate stakes to within 0.25 feet of the true horizontal position, and establish the grade elevation to within 0.03 feet of the true vertical position.

D Measurement

The department will measure Construction Staking Subgrade Parking Lot as a lump sum unit acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.005	Construction Staking Subgrade Parking Lot	LS

Payment is full compensation for locating and setting all construction stakes; for relocating and resetting damaged or missing construction stakes, for furnishing all labor, tools, stakes, lath, flags, equipment and incidentals necessary to complete the work.

38. Construction Staking Concrete Pavement Parking Lot, SPV.0105.006.**A Description**

This work shall consist of contractor performed construction staking required of the concrete pavement for the parking lot.

B (Vacant)**C Construction**

Set construction stakes or marks at a minimum of 25-foot intervals. Set and maintain additional stakes as necessary to establish location and grade along intersecting radii; and for vertical curves, horizontal curves, and curve transitions according to the plan. Locate stakes to within 0.02 feet of the true horizontal position, and establish elevations to within 0.01 feet of the true vertical position. Set and maintain sufficient additional stakes at each cross section to achieve the required accuracy and to support the method of operations.

D Measurement

The department will measure Construction Staking Concrete Pavement Parking Lot as a lump sum unit, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.006	Construction Staking Concrete Pavement Parking Lot	LS

Payment is full compensation for locating and setting all construction stakes; for relocating and resetting damaged or missing construction stakes, for furnishing all labor, tools, stakes, lath, flags, equipment and incidentals necessary to complete the work.

39. Concrete Pavement Joint Layout, Item SPV.0105.007.**A Description**

This special provision describes providing a concrete pavement or concrete base joint layout design for intersections and marking the location of all joints in the field.

B (Vacant)

C Construction

Plan and locate all points necessary to establish the horizontal position of the transverse and longitudinal joints in the concrete to prevent uncontrolled cracking. Submit a joint layout design to the engineer before paving each intersection. Mark the location of all concrete joints in the field. Follow the plan details for joints in concrete making adjustments as required to fit field conditions

D Measurement

The department will measure Concrete Pavement Joint Layout as a lump sum unit for all joint layout designs and marking, acceptably completed under the contract.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.007	Concrete Pavement Joint Layout	LS

Payment is full compensation for providing the intersection joint layout designs and marking all joints in the field.

The department will adjust pay for crack repairs as specified in standard spec 415.5.3.

40. General Requirements for Building Construction.

These general requirements are applicable to the following bid items for the SWEF building construction:

- SWEF Building, General Construction
- SWEF Building, Plumbing
- SWEF Building, Heating and Ventilating
- SWEF Building, Electrical

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

DIVISION 00 – CONTRACTING REQUIREMENTS

SECTION 00 72 00 – GENERAL CONDITIONS

PART 1 - GENERAL

1.01 REFERENCED DOCUMENT

A. AIA DOCUMENT A201, 2007 EDITION

1. The “General Conditions of the Contract for Construction” AIA Document A201 - 2007, published by the American Institute of Architects, is hereby made a part of the contract documents.

2. Copies of the AIA documents can be obtained from:

AIA Wisconsin
321 South Hamilton Street
Madison WI 53703-4000
Phone: (608) 257-8477
Fax: (608) 257-0242

PART 2 – PRODUCTS (NOT APPLICABLE).

PART 3 – EXECUTION (NOT APPLICABLE).

END OF SECTION 00 72 00

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 11 00 – SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

A. "Primary or Lead Contractor": The Roadway Contractor is the Primary or Lead Contractor. Refer to the Roadway Special Provisions for the Primary or Lead Contractor's Scope of Work.

B. "General Building Contractor": The General Building Contractor shall be a subcontractor to the Roadway Contractor. The Work described in Divisions 1-33 are the responsibility of the General Building Contractor.

C. "Standard Specifications": Refers to the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Edition of 2003.

D. "Roadway Special Provisions": Refers to the requirements for the roadway portion of the project.

E. "Building Specifications": Refers to the building specifications Divisions 1-33.

1.03 PROJECT DESCRIPTION

A. The BUILDING portion of the Project consists of

1. A new Safety and Weight Facility to be constructed near Sparta, WI. The facility will include offices, toilet facilities, storage areas, and truck inspection bays.

B. The BUILDING portion of the Work consists of:

1. Construction will include a first floor area, recessed inspection pits, and underground access to a static scale. Work includes, but is not limited to concrete foundations, structural steel with metal decks, masonry exterior, metal studs and drywall, aluminum windows, standing seam metal roof system, acoustic ceilings, painting, quarry tile flooring, carpeting, hollow metal doors and frames, wood

doors, metal doors, finish hardware, casework and millwork. Also included is plumbing, HVAC, electrical, and communications cable and equipment.

C. State Prevailing Wage Rates apply to the Work described in Divisions 1 through 33.

1.04 WORK SEQUENCE AND SCHEDULE

A. The Work sequence for the Divisions 1 through 33 will be the General Building Contractor's responsibility to coordinate with the Owner, the engineer, and all required Trades.

B. Refer to the Roadway Special Provisions for Substantial (Interim) and Final Building Completion dates.

1.05 PERMITS

A. Local building permits shall be the responsibility of the General Building Contractor.

PART 2 – PRODUCTS (NOT APPLICABLE).

PART 3 – EXECUTION (NOT APPLICABLE).

END OF SECTION 01 11 00

SECTION 01 25 00 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This section refers to substitutions for the BUILDING portion of this contract only. Refer to "Submittals" in the Roadway Special Provisions for non-building substitutions.

1.02 EQUALS AND SUBSTITUTIONS

A. It is not the intention of the State of Wisconsin Dept. of Transportation to limit or restrict competition by the use of any "Brand Name", reference to a particular manufacturer, process, technique, catalog number or other identifying information. Such proprietary specifications or use of "Brand Names" are intended to establish a level of quality or the minimum essential requirements to which the Contractor must conform, unless more explicit restrictions are stated to apply.

B. Substitutions: Substitutions may be used where 'approved equal' is specified. Substitutions must be approved by the engineer, and must meet or exceed specifications listed.

1. The burden of proof that a substitution meets or exceeds the specifications shall be the responsibility of the proposer.

C. For approval, the proposer must submit required data to the engineer according to Section 01 33 00 – Submittal Procedures.

1. Submit concise, annotated documentation comparing the specification to the proposed substitution.

D. When the Contract Documents list performance or functional characteristics in connection with Work to be performed, these characteristics are mandatory for reasons of design. Use of any "Equal" or "Substitution" shall be subject to the prior written approval of the Architect.

E. Material, equipment, or processes offered for use as an "Equal" or "Substitution" may be proposed by the Contractor in writing. Such proposals shall guarantee the proposed "Equal" or "Substitution" to be capable of performing the duties of the originally specified material, equipment, or process. The Architect shall respond to any such proposal as soon as practicable but in no case later than seven (7) working days after receipt of such proposal.

F. It shall be the sole responsibility of the Contractor to provide all documentation, regardless of type or quantity to clearly establish the qualifications of items proposed as 'Equals' or 'Substitutions' under this Article 17. If the value of the 'Equal' or

'Substitution' is less than the item specified in the Contract Documents, then an equitable reduction of the price of the Contract shall be made.

G. When 'Equals' or 'Substitutions' are approved by the Architects and incorporated into the Project by the Contractor, all costs incurred to 1) correct deficiencies in items, 2) provide for installation or hookup , or 3) to achieve performance specified in the Contract Documents, will be borne by the Contractor.

H. Any substitute material or equipment installed by the Contractor without approval of the Architect shall be subject to immediate removal and all costs required to conform to the Contract Documents shall be borne by the Contractor.

I. The Contractor shall assume all liability and responsibility for any changes in the Work including agreed to Value Engineering changes or additional Work, required to accommodate use of proposed and approved 'Equals' or 'Substitutions' does not relieve the Contractor from the obligation to coordinate such changes with the Work may be affected by them, and to pay all additional costs resulting from their inclusion in the Work may be affected by them and to pay all additional costs resulting from their inclusion in the Work, even if additional costs or Work become apparent after execution of the change or installation of the 'Equal' or 'Substitution'. The Contractor's liability shall include payment of any additional costs incurred by the Wisconsin Dept. of Transportation made necessary by, or directly connected to, such changes.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION 01 25 00

SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 1 specification sections, apply to this section.

1.02 SUMMARY

A. This section includes administrative provisions for coordinating construction operations on project including but not limited to, the following:

1. Coordination Drawings
2. Administrative and Supervisory Personnel
3. General Project Coordination Procedures
4. Project Meetings

B. Related Sections:

1. Division 1 Section 'Construction Progress Documentation' for preparing and submitting the contractor's construction schedule.

1.03 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base coordination drawings on reproductions of the contract documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical and electrical systems.
 - b. Indicate required installation sequences
 - c. Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the contract.

B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at project site. Identify individuals and their duties and responsibilities ; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to project.

1. Post copies of list in project meeting room, in temporary field office and by each temporary telephone.

1.04 COORDINATION

A. Coordinate construction to ensure efficient and orderly installation of each part of the work.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its installation.
2. Coordinate installation of components to ensure maximum accessibility for required maintenance, service and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports and list of attendees at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:

1. Preparation of contractor's construction schedule.
2. Preparation of the schedule of values
3. Installation and removal of temporary facilities and controls
4. Delivery and processing of submittals
5. Progress meetings
6. Pre-installation meetings
7. Project closeout activities

1.05 PROJECT MEETINGS

A. General: Schedule and conduct meetings at project site

1. Attendees: Inform participants and others involved and individuals whose presence is required, of date and time of each meeting. Notify owner and architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute meeting minutes to everyone concerned, included owner and architect, within three days of meeting.

B. Pre-construction Meeting: Schedule a pre-construction meeting before starting construction at a time convenient to owner and architect, but no later than 15 days after execution of the agreement. Hold the meeting at project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Agenda: Discuss items of significance that could affect progress, including:
 - a. Tentative Construction Schedule
 - b. Phasing
 - c. Critical Work Sequencing
 - d. Designation of Responsible Personnel
 - e. Procedures for Processing Field Decisions and Change Orders
 - f. Procedures for Processing Applications for Payment
 - g. Submittal Procedures
 - h. Preparation of Record Documents
 - i. Use of the Premises
 - j. Responsibility for Temporary Facilities and Controls
 - k. Parking
 - l. Office, Work and Storage Areas
 - m. Equipment Deliveries and Priorities
 - n. First Aid
 - o. Security
 - p. Progress Cleaning
 - q. Working Hours

C. Pre-Installation Meetings: Conduct a pre-installation meeting at project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

- a. Contract Documents
- b. Options
- c. Related Change Orders
- d. Purchases
- e. Deliveries
- f. Submittals
- g. Review of Mockups
- h. Possible Conflicts
- i. Compatibility Problems
- j. Time Schedules
- k. Manufacturer's Written Recommendations
- l. Warranty Requirements
- m. Compatibility of Materials
- n. Acceptability of Substrates
- o. Temporary Facilities and Controls
- p. Space and Access Limitations
- q. Regulations of Authorities Having Jurisdiction
- r. Testing and Inspecting Requirements
- s. Required Performance Results
- t. Protection of Construction and Personnel

3. Record significant conference discussions, agreements and disagreements.

4. Do not proceed with installation if the meeting cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the work and reconvene the meeting at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of the owner, the architect and the contractor, each subcontractor, supplier and other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with project and authorized to conclude matters relating to the work.

2. Agenda: Review and correct or approve minutes of previous progress meeting.

Review W items of significance that could affect progress. Include topics for discussion as appropriate to status of project.

- a. Contractor's Construction Schedule: Review progress since the last meeting. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time.

b. Review present and future needs of each entity present, including the following:

- I. Interface Requirements
- II. Sequence of Operations
- III. Status of Submittals
- IV. Deliveries
- V. Off-Site Fabrication
- VI. Access
- VII. Site Utilization
- VIII. Temporary Facilities and Controls
- IX. Work Hours
- X. Hazards and Risks
- XI. Progress Cleaning
- XII. Quality and Work Standards
- XIII. Change Orders
- XIV. Documentation of Information for Payment Requests

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

4. Schedule Updating: Revise contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION 01 31 00

SECTION 01 32 00 – PROGRESS DOCUMENTATION AND PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This section is covered in the sections entitled "Prosecution and Progress" in the Standard Specifications and in the Roadway Special Provisions.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION 01 32 00

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUBMITTAL REVIEW: A/E approval is required for submittals described herein.

1.02 DEFINITIONS

A. Submittal Descriptions (SD)-Submittals requirements are specified in the technical sections. Submittals are identified by submittal Description (SD) numbers and titles as follows:

1. SD-01 Preconstruction Submittals - Submittals which are required prior to start of construction (work) or commencing work on site or the start of the next major phase of the construction on a multi-phase contract. Includes schedules, tabular list of data, or other pertinent information regarding products, materials, equipment, or components to be used in the work, submitted prior to start of construction work or next major phase of construction.
 - a. Certificates of insurance
 - b. Surety bonds
 - c. List of proposed Subcontractors
 - d. List of proposed products
 - e. Construction Progress Schedule
2. SD-02 Shop Drawings
 - a. Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.
 - I. Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.
3. SD-03 Product Data
 - a. Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.
 - b. Samples of warranty language when the contract requires extended product warranties.
4. SD-04 Samples
 - a. Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

- b. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.
 - c. Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.
- 5. SD-05 Design Data
 - a. Design calculations, mix designs, analyses or other data pertaining to a part of work.
 - b. Design submittals, design substantiation submittals and extensions or design submittals.
- 6. SD-06 Test Reports
 - a. Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project)
 - b. Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.
 - c. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
 - d. Investigation reports.
 - e. Daily logs and checklists
 - f. Final acceptance test and operational test procedure
- 7. SD-07 Certificates
 - a. Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.
 - b. Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.
- 8. SD-08 Manufacturer's Instructions
 - a. Preprinted material describing installation of a product, system or material, including special notices and (MSDS) concerning impedances, hazards and safety precautions.

9. SD-09 Manufacturer's Field Reports
 - a. Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.
 - b. Factory test reports.
10. SD-10 Operation and Maintenance Data
 - a. Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.
 - b. This data is intended to be incorporated in an operations and maintenance manual or control system.
11. SD-11 Closeout Submittals
 - a. Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.
 - b. Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.03 QUANTITY OF SUBMITTALS

- A. Number of Copies of SD-02 Shop Drawings and SD-03 Product Data.
 1. Submit six (6) hard copies of submittals, or electronic transmission of submittals of shop drawings, product data and/or manufacturer's instructions requiring review and approval by the A/E.
- B. Number of Samples SD-04 Samples
 1. Submit two (2) samples, or one (1) set of samples showing manufacturer's range of standard finishes/colors. One approved sample will be retained by A/E and one will be returned to Contractor.
- C. Number of Copies SD-05 Design Data and SD-07 Certificates
 1. Submit in compliance with quantity requirements specified for shop drawings.

- D. Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports.
 - 1. Submit in compliance with quantity requirements specified for shop drawings other than field test results.
- E. Number of Copies of SD-10 Operation and Maintenance Data
 - 1. Submit three (3) hard copies of O&M Data to the A/E for review and approval.
- F. Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals
 - 1. Unless otherwise specified, submit two sets of administrative submittals.

1.04 VARIATIONS

- A. Variations from contract requirements require approval of the A/E and will be considered where advantageous to Owner.
- B. Considering Variations
 - 1. Discussion with A/E prior to submission will help ensure functional and quality requirements are met and minimize rejections and re-submittals.
 - 2. Specifically point out variations from contract requirements. Failure to point out deviations may result in the A/E rejection.
- C. Proposing Variations
 - 1. When proposing variation, deliver written request to the A/E, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Owner. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.
- D. Warranting That Variations Are Compatible
 - 1. When delivering a variation for approval, the contractor, warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.05 SCHEDULING

A. Deliver submittals to the A/E on a timely basis that allows a review period of at least fifteen (15) days from date of receipt by the A/E. No delay damages or time extensions will be allowed for time lost as a result of late submittals.

1. For submittals requiring review by fire protection engineer, allow review period, beginning when the A/E receives submittal from the contractor.
2. Period of review for each resubmittal is the same as for initial submittal.

1.06 SUBMITTAL REVIEW

A. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with the requirements of the drawings and specifications.

B. The contractor is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Submittals shall be reviewed by the General Contractor prior to forwarding onto the A/E and shall indicate field measurements, quantities and site conditions that will impact the installation covered by the submittal.

C. Review Notations

—

1. A/E review will be completed within fifteen (15) calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:
 - a. Submittals marked “approved” or “accepted” authorize the Contractor to proceed with the work covered.
 - b. Submittals marked “approved as noted” or “approved except as noted, resubmittal not required,” authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.
 - c. Submittals marked “not approved” or “disapproved.” Or “revise and resubmit,” indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.
 - d. Submittals marked “not reviewed” will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked “not reviewed” will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.07 DISAPPROVED (OR REJECTED) SUBMITTALS

A. Contractor shall make corrections required by the A/E. The A/E shall be notified if the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications.

B. If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals according to the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.08 APPROVED (/ACCEPTED) SUBMITTALS

A. The A/E's approval or acceptance of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactory. The contractor is responsible for confirming and correlating all quantities and dimensions.

1.09 APPROVED SAMPLES

A. Approval of a sample is only for the characteristics or use named in such approval and is not to be construed to change or modify any contract requirements. Before submitting samples, the Contractor is to assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

B. Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at his expense, if so requested.

C. Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. The A/E reserves the right to disapprove any material or equipment to meet contract requirements.

D. Samples of various materials or equipment delivered on the site or in place may be taken by the A/E for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

END OF SECTION 01 33 00

SECTION 01 40 00 – QUALITY REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Division I specification sections, apply to this section.

1.02 SUMMARY

A. This section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the contractor of responsibility for compliance with the contract document requirements.

1. Specified tests, inspection and related actions do not limit the contractor's quality-control procedures that facilitate compliance with the contract document requirements.

2. Requirements for the contractor to provide quality-control services required by architect, owner or authorities having jurisdiction are not limited by provisions of this section.

C. Related section include:

1. Divisions 2 through 16 sections for specific test and inspection requirements.

1.03 DEFINITIONS

A. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selection made under sample submittals, to demonstrate aesthetic effects and workmanship, qualities of materials and execution and to review construction, coordination, testing or operation; they are not samples.

B. Testing Agency: An entity engaged to perform specific tests, inspections or both. Testing laboratory shall mean the same as testing agency.

1.04 SUBMITTALS

A. Qualification Data: For testing agencies specified in 'Quality Assurance' article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Reports: Certified written reports that include:

1. Date of issue
2. Project Title and Number
3. Name, Address and Telephone Number of Testing Agency
4. Dates and Locations of Samples and Tests or Inspections
5. Description of the Work and Test and Inspection Method
6. Identification of Product and Specification Section
7. Complete Test or Inspection Data
8. Test and Inspection Results and an Interpretation of Test Results
9. Ambient Conditions at Time of Sample Taking and Testing and Inspection
10. Opinions on Whether Tested or Inspected Work Complies with the Contract Documents.
11. Name and Signature of Laboratory Inspector
12. Recommendations of Retesting and Reinspecting

C. Permits, Licenses and Certificates: For owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records and similar documents, established for compliance with standards and regulations bearing on performance of the work.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of the manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design and extent to those indicated for this project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as

those performed for installations of the system, assembly or product that are similar to those indicated for this project in material, design and extent.

F. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

G. Mockups: Before installing portions of the work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed work:

1. Build mockups in location and of size indicated or, if not indicated as approved by architect. Notify architect five days in advance of dates and times when mockups will be constructed.
2. Demonstrate the proposed range of aesthetic effects and workmanship.
3. Obtain architect's approval of mockups before starting work, fabrication and construction.
 - a. Approval of mockups does not constitute approval of deviations from the contract documents contained in mockups unless such deviations are specifically approved by architect in writing.
4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
5. Demolish and remove mockups when directed, unless otherwise indicated.

1.06 QUALITY CONTROL

A. Unless otherwise indicated, provide quality-control services specified or required by authorities having jurisdiction.

1. When services are indicated as the contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Notify testing agencies at least 24 hours in advance of time when work that requires testing or inspecting will be performed.
 - b. Submit a certified written report, in duplicate, of each quality-control service.
2. When services are indicated to be performed by independent agencies the owner will separately contract to provide inspections, tests and similar quality control services.
 - a. The contractor shall provide administrative help to the owner for such services, including recommendations for agencies and preparation of contracts. Agencies shall invoice the owner directly.

b. Agencies under contract with the owner shall not perform duties under contract with the contractor.

3. Testing and inspecting requested by contractor and not required by the contract documents are the contractor's responsibility.

4. Submit additional copies of each written report directly to authorities having jurisdiction when they do direct.

B. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

C. Retesting and Reinspecting: Regardless of whether original tests or inspections were contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the contract documents.

D. Testing Agency Responsibilities: Cooperate with architect and contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify architect and contractor promptly of irregularities or deficiencies observed in the work during performance of its services.

2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

3. Submit a certified written report in duplicate, of each test, inspection and similar quality-control service through contractor.

4. Do not release, revoke, alter or increase requirements of the contract documents or approve or accept any portion of the work.

5. Do not perform duties of the contractor.

E. Associated Services: Cooperate with agencies performing required tests, inspections and similar quality-control services and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the work

2. Incidental labor and facilities necessary samples of materials that require testing and inspecting.

3. Adequate quantities of representative samples of materials that require testing and inspecting.
4. Assist agency in obtaining samples
5. Facilities for storage and field curing of tests samples
6. Delivery of samples to testing agencies
7. Preliminary design mix proposed for use for material mixes that require control by testing agency
8. Security and protection for samples and for testing and inspecting equipment at project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples and similar activities.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 REPAIR AND PROTECTION

A. General: On completion of testing, inspections, sample taking and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other sections of these specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are the contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 50 00 – TEMPORARY FACILITIES AND SERVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Refer to Divisions 22, 23 and 26 for temporary building facilities and services such as heat and lighting.

B. Temporary site facilities and services are provided by the roadway contractor, and are covered elsewhere in the Standard Specifications and in these Roadway Special Provisions.

PART 2 – SERVICES

2.01 FENCING

A. The General Building Contractor shall provide a neat appearing movable prefabricated chain link security fence where indicated on the drawings around contractors staging areas and perimeter of exterior excavations for new footings and foundations. Provide gates, properly constructed and braced, complete with hinges, hasps, and padlocks in number and location required for proper control, delivery and distribution of material and equipment.

B. Barricade Fencing: Plastic barricade type fencing shall be used for utility trenching.

C. All protective fencing shall be maintained in an upright, orderly fashion throughout the construction schedule. In areas where existing trees are to be protected, the area inside the protective fencing shall not be used for any purpose related to construction activities, such as material storage, vehicle parking, portable toilets, or other disruptive activities that would result in damage of any kind to the site inside the fence.

2.02 TOILETS

A. The General Building Contractor shall provide and maintain sanitary outdoor temporary toilets, in sufficient number required for the force employed. The toilets shall comply with International Building Code Chapter 29 on Plumbing Systems. Toilets shall be self-contained chemical type.

2.03 TELEPHONES

A. It is expected that each contractor have access to their own cell phone for their own use. No additional telephone service will be provided

2.04 WATER SUPPLY

A. The General Building Contractor shall supply all water required for construction and other purposes until the permanent water supply system is accepted and in operation.

B. Lavatory and slop sinks used by workmen shall be kept clean and sanitary at all times.

C. Immediately after award of contract, the Plumbing Trade shall make arrangements for maintaining temporary connections and extension of existing water service facilities. As soon as possible, the Plumbing Trade shall install the permanent main into the building and provide a temporary gate valve, extend piping, provide temporary water meter, and provide two 3/4" hose bibbs on each floor, located where directed. Permanent risers may be used for temporary service. Provide two 3/4" hose bibbs outside of the building at suitable locations for construction purposes where directed.

D. The Plumbing Trade shall supply, maintain the installation, and remove it when directed by General Building Contractor and shall provide necessary patching of surfaces and structure after such temporary service is removed.

E. The General Building Contractor shall prevent waste of water and shall maintain valves, connections, and hoses in perfect condition, at all times. Trades shall provide their own hose or piping from hose bibbs.

F. Immediately after award of contract, the Plumbing Trade shall make arrangements to begin underground sewer work and shall complete sewer work, including backfilling required, as soon as possible.

2.05 TEMPORARY ELECTRICAL WORK

A. For this project, provide a 200 amp. 120/240 VAC, Single-phase, 3-wire electric service for use by the Contractors for small power tools, temporary field offices, temporary lighting or for operation of construction equipment and testing. Trades requiring voltage other than basic temporary system specified, or a special single phase run, shall make their own arrangements with the Owner for cost of energy used, and the Electrical Trade for the cost of installation, and removal when no longer required.

B. The General Building Contractor shall pay for all electrical energy consumed for construction purposes for all trades including temporary offices, for operation of ventilating equipment, and for testing and operating of all equipment.

- C. Any Trade that has a temporary office shall provide and pay for installation of temporary service for lighting of such temporary office.
- D. The Electrical Trade shall provide, at no cost to others, all lamps, wiring, switches, sockets and similar equipment required for temporary system until substantial completion. Upon completion of the project, the Electrical Trade shall remove the temporary system.
- E. The temporary lighting system shall be sufficient to enable all trades to safely complete their work and to enable the Lead Contractor to check all work as it is being done. Illumination shall be 5 foot-candles minimum in all areas and, in addition, shall meet or exceed the requirements of 29 CFR 1926.56 Illumination (OSHA regulations).
- F. Provide at least one duplex outlet for small power tools for each 400 square feet of floor space, 120 volt single phase. Circuits shall be 20 ampere, single pole.
- G. According to the latest issue of the National Electrical Code, all temporary electrical circuits for construction purposes shall be equipped with combination ground fault interrupter and circuit breakers meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test button shall be provided for checking the device. The breaker mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with over center switching mechanism so that contact cannot be held closed.
- H. All Trades shall furnish their extension cords and lamps other than those furnished for general lighting.
- I. All Trades and other separate Contractors shall be allowed to use electric service provided for general lighting and fractional horsepower hand tools at no cost.
- J. Trades requiring voltage other than basic temporary system, three phase power, or a special single phase run, for operation of construction equipment or testing shall make their own arrangements with the Lead Contractor and Electrical Trade for the cost of installation, and removal when no longer required.
- K. Heating and Ventilating Trade shall provide wiring, equipment and connections for portable or temporary heating units.
- L. The Electrical Trade shall expedite the work under this contract in such a manner that the permanent power wiring system and panels will be installed and connected to permanent heating and ventilating equipment in time to operate and test this equipment to permit the use of portions of heating and ventilating system for temporary heating during construction. Permanent wiring and connections may be used at permanent equipment; however, the use of the permanent system during construction shall in no way waive any part of the guarantee period.

M. After Substantial Completion of the permanent electrical system and building wiring, permanent receptacles may be used during finishing work. Permanent wiring for lighting fixtures, switches and receptacles shall be installed only after all masonry and plastering has been completed, but this wiring shall not be used for motors larger than fractional HP or for welding equipment. Circuits for larger motors and welding equipment may be provided with special circuits to mains of electrical panels at the expense of those trades requiring them, provided that special permission is obtained from Lead Contractor and the installation is made by skilled electricians.

2.06 COLD WEATHER PROTECTION

A. All heating and protective covering, required to protect the work from injury due to freezing and moisture during the construction period and prior to enclosure of the building, shall be classed as COLD WEATHER PROTECTION. Such protection shall be provided and paid for by the General Building Contractor.

B. Heat required to protect materials from injury due to freezing during the construction period and prior to enclosure, shall be provided by means of portable heating units intended for this purpose.

C. All heating units must be approved types. Proper ventilation must be provided. The use of temporary units whose product of combustion will damage fresh concrete, mortar or other building materials, will not be allowed. Use of coke or oil salamanders is prohibited.

D. If electrical power is required for oil or gas portable heating units, it may be taken from the available temporary power source and paid for by the General Building Contractor.

E. Heating units and the area surrounding the units shall be kept in a clean and safe condition.

2.07 ENCLOSURE

A. Before the building, or portion thereof, can be considered enclosed, the General Building Contractor shall have advanced the construction of the building to conform with the following requirements.

B. The exterior walls should be erected to full thickness and height shall extend to the top of the horizontal level which encloses the space intended to receive heat. If erection of full thick walls is not feasible, erection of back-up wall only will be accepted if approved weatherproofing of back-up materials is provided to avoid damage to back-up materials.

C. The horizontal slab, which will serve as the overhead enclosure of the spaces to receive heat (whether it be the roof slab or intermediate floor slab), shall have all openings covered with closures capable of sustaining any loads imposed thereon. The entire overhead enclosure shall be made weatherproof.

D. Provide approved translucent material for temporary enclosure of window openings if they have not been glazed. Plain or reinforced polyethylene film or other suitable translucent material will be acceptable, provided it is installed in or on a well-fitting rigid wood frame and kept in good repair. This means of temporary enclosure shall be used for other minor openings in walls.

E. Construct temporary walls as required to protect contents and to separate the interior enclosed sections from the interior open section of the building during construction. Temporary wall enclosure shall consist of plywood panels, at least 3/8" thick, fastened to wood framework, consisting of 2 x 4 studs spaced 24" o.c., securely spiked to wood plates, top and bottom. Provide intermediate girts between studs as required for fastening of plywood. Temporary walls must provide protection from dirt, dust, and drafts.

F. Provide exterior doors with hinges, self-closing device, and locks.

G. Make suitable provisions for passage of air to permit proper drying out of the building.

H. At end of day's work, securely close temporary enclosures. Padlock exterior doors. The General Building Contractor shall supervise effectiveness of enclosures.

I. Where reference is made to a "portion of the building", it is intended to mean definable areas of the building such as a group of floor levels or an entire wing of the building. It is not intended to require a room-by-room or erratic piece-meal enclosure operation, but shall provide for an orderly expansion of large adjacent or related areas to be enclosed which are advantageous to the progress of the work and approved by Lead Contractor.

2.08 TEMPORARY HEAT

A. All heating required after enclosure of the building up to substantial completion shall be classified as TEMPORARY HEAT. Enclosure is defined in preceding Article.

B. It shall be the responsibility of the General Building Contractor to see that every precaution is used to prevent unnecessary escape of heat.

C. For installations that are not connected to central plant steam or central plant hot water, the lead contractor shall pay the fuel costs for temporary heat for both permanent heating systems used for temporary heat and/or temporary heating systems used for temporary heat.

D. The General Building Contractor shall pay for all electrical energy consumed for temporary heat.

E. The Heating Trade shall provide one of the following systems or a combination thereof, for furnishing temporary heat:

1. Permanent heating system may be used for temporary heating. If permanent system is used, the Heating Trade shall install in their permanent location heating coils or connectors as approved by Lead Contractor, with controls to maintain temperatures required. Temporary filters shall be used in the permanent system. Provide bases, shields, etc., around heating elements to prevent too rapid drying of adjacent concrete, masonry or plaster. Relocation of some of the permanent heating system equipment may be required during construction to prevent interference with new construction. Temporary units may be installed in such areas during the time permanent equipment is not operating due to relocation
2. The distribution piping of the permanent heating system may be utilized for supply and return to unit heaters on each floor in lieu of temporary piping, provided approved connections, controls and protection of such piping is maintained.
3. If the permanent air system is used during temporary heating period, temporary filters shall be provided in the system and they shall have efficiency equal to the permanent filters. The return air ductwork shall be protected from construction dirt by temporary filters placed over return openings.

F. If the Heating Trade does not have one of the above systems in operation by the time the building is enclosed, then the Heating Trade shall provide, maintain and supervise the operation of temporary portable units with necessary automatic controls to provide required temperatures. Current required may be taken from the temporary electrical service. See "Temporary electrical Installation". Cost of fuel to operate portable units shall be paid by the lead contractor.

G. All electrical wiring required for temporary heating units shall be furnished and installed by Heating Trade, from temporary wiring service. Electrical wiring to permanent equipment used for temporary heating that has been mounted in its permanent location shall be wired by trades skilled in that work.

H. The use of open salamanders as portable heating units will not be approved. All portable temporary heating units shall be properly ventilated to prevent combustion gases from remaining in the heating area.

I. The Heating Trade must ascertain if heating equipment will operate on the temporary electrical service available. If service is insufficient to operate equipment, Heating Trade shall make other arrangements.

J. The Heating Trade shall be responsible for the proper adjustment and maintenance of the system, and shall supervise and be responsible for the operation of the system used for temporary heating until State occupies the building. Supervision shall include periodic checking of operation as required.

K. A minimum temperature of 45 degrees and a maximum temperature of 60 degrees for the building shall be maintained by the Heating Trade, except for a period of at least ten days prior to the placing of interior woodwork and throughout the placing of this and other finish, varnishing, painting, etc., and until substantial completion to provide sufficient heat to ensure a temperature in the spaces involved of not less than 70 degrees nor more than 80 degrees.

L. The temporary heating system shall be removed by the Heating Trade after the permanent heating system has been installed and operating. Surfaces and structure shall be patched as required. Temporary heating equipment shall be relocated by the Heating Trade as required during construction to prevent interference with new construction.

M. At completion of construction work or when temporary heat is no longer required, Heating Trade must repair any damage done to permanent equipment during temporary heating period and also perform the necessary cleaning of all ducts and equipment. The Heating Trade shall provide permanent filters to the complete satisfaction of Lead Contractor.

2.09 FIRE PROTECTION

A. The General Building Contractor shall provide and maintain in working order during the entire construction period, a minimum of three (3) fire extinguishers on each floor level of the building, and one (1) in temporary office. Extinguishers shall be non-freeze type such as A-B-C rated dry chemical, of not less than 10-pound capacity each. In addition, any Subcontractor who maintains an enclosed shed on the site shall provide and maintain, in an accessible location, one or more similar nonfreezing type fire extinguisher in each enclosed shed.

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION 01 50 00

SECTION 01 73 00 – EXECUTION REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.
9. Sleeves and Openings
10. Cutting and patching

B. Related Sections include the following:

1. Standard Specifications "Prosecution and Progress" for procedures for coordinating field engineering with other construction activities.

1.03 SUBMITTALS

A. SD-03 Qualification Data: For land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of the engineer and owners, and other information specified.

B. SD-07 Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. SD-07 Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. SD-05 Final Property Survey: Submit 10 hard copies and two (2) electronic versions (CD or DVD) showing the Work performed and record survey data.

1.04 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of storm sewer and water-service piping; and underground electrical services.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

- a. Description of the Work.
- b. List of detrimental conditions, including substrates.
- c. List of unacceptable installation tolerances.
- d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: 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:

1. Notify engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without engineer's written permission.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to engineer. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify engineer promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify engineer when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations (refer to structural plans for detail denoting control between site and foundation).

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by engineer.

3.04 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to engineer before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet (2.4 m) in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by engineer.

2. Allow for building movement, including thermal expansion and contraction.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 SLEEVES AND OPENINGS

A. Each Contractor requiring sleeved openings shall furnish all sleeves required for their penetrations whether or not they are responsible for providing the respective openings. Contractors furnishing sleeves to others for installation shall do this in a timely manner so as not to impede the project schedule.

B. Openings shown on the structural and/or architectural drawings shall be the responsibility for the Lead Contractor. Sleeves furnished by other contractors for openings shown on the structural and/or architectural drawings shall be installed by the Lead Contractor.

C. Openings that are required and are not shown on the structural and/or architectural drawings shall be the responsibility of the contractor requiring the openings. The contractor requiring the opening shall install sleeves for these openings or cut openings as needed (including floor openings within chases).

D. Individuals skilled in such work shall accomplish installation of sleeves and openings.

E. Each Contractor shall be responsible for coordinating locations of their sleeves with work of other trades.

F. Each Contractor who requires sleeves and/or openings shall submit through the Construction Manager to the A/E for review and approval, layout drawings of all such required sleeves and/or openings. Sleeve and openings layout drawings shall be received by the Construction Manager a minimum of two weeks prior to installation of the sleeves and openings. Sleeve and opening sizes and locations shall be dimensioned from column lines and floor elevations or from a point of reference approved by A/E.

3.07 CUTTING AND PATCHING

A. Cutting and patching required to access work in existing walls, in chases, above inaccessible ceilings, below floors, etc., shall be by the Contractor who requires the access, unless shown on the bid documents otherwise or noted otherwise.

B. The Contractor shall do all cutting, or fitting of the work as required to make its several parts fit together, or to receive the work of others, as shown or reasonably implied by the drawings or specifications, or as may be directed by A/E. Holes cut in exterior walls and/or roofs shall be waterproofed.

C. The Contractor who cuts shall also be responsible for patching. Where cutting and patching is required, the Contractor shall hire individuals skilled in such work to do cutting and patching.

D. The Contractor who removes or relocates building components which leaves a remaining opening shall be responsible for patching the opening.

E. Patching includes repairing openings to match adjacent construction and painting the surface to match existing. Painting means covering the entire wall where patching is to be done to nearest break point or corner unless indicated to be done by other trades.

F. Contractor shall not endanger any work by cutting, digging, or otherwise and shall not cut or alter the work of others without their consent.

G. Do not pierce beams or columns without permission of A/E and then only as directed in writing. If any ductwork, piping, conduit, etc. is required through walls or floors where no sleeve has been provided, use a core drill or saw cut to prevent damage and structural weakening.

H. Wherever any material, finish, or equipment, is damaged, the skilled trade shall accomplish the repair or replacement in that particular work and the cost shall be charged to the party responsible for the damage. The A/E reserves the right to disallow any means and/or methods that, in the opinion of A/E, are harmful to and/or not in the best interest of preserving the improvements receiving the work.

3.08 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of General Building Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Pre-installation Conferences: Include Owner's construction forces at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.09 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris. Temperature is expected to rise above 80 deg. F. (27 deg C).
2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.11 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.12 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 74 23 – FINAL CLEANING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for final cleaning at Substantial Completion.

1. Special cleaning requirements for specific elements of the Work are included in appropriate Sections of the specifications.

B. General Project closeout requirements are included in Section "Project Closeout."

C. General cleanup and waste removal requirements are included elsewhere in the Standard Specifications.

D. Except as otherwise indicated, each General Building Contractor is responsible for final cleaning of their own work. The General Building Contractor is responsible for coordination of final cleaning where more than one prime Contractor is involved in final cleaning a single area or piece of equipment.

E. Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.

2. Do not burn or bury debris, rubbish or other waste material on the premises.

PART 2 - PRODUCTS: (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 FINAL CLEANING

- A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- B. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion for the entire Project or a portion of the Project. Complete checklist B, sign form, and submit to engineer.
- C. Compliance: Remove waste materials from the site and dispose of in a lawful manner.
 - 1. Where extra materials of value remain after completion of associated construction have become the Owner's property, dispose of these materials as directed.
- D. Removing Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

FINAL CLEANING - CHECKLIST 'B'

- ☐ Clean the Project site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign deposits. Rake grounds that are neither planted nor paved, to a smooth even-textured surface.
- ☐ Remove tools, construction equipment, machinery and surplus material from the site.
- ☐ Remove snow and ice to provide safe access to the building.
- ☐ Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
- ☐ Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
- ☐ Wash concrete floors in unoccupied spaces.
- ☐ Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.
- ☐ Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
- ☐ Remove labels that are not permanent labels.
- ☐ Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.
- ☐ Wipe interior surfaces of all cabinetwork including shelves, vertical dividers, and drawers.
- ☐ Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.
- ☐ Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- ☐ Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated for temporary facilities during construction.
- ☐ Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out bulbs, and defective and noisy starters in fluorescent and mercury vapor fixtures.
- ☐ Leave the Project clean and ready for occupancy.

To the best of my knowledge, the above list has been completed.

General Building Contractor Signature

Representing

Date

Return this completed, signed form to the engineer prior to requesting inspection for Substantial Completion.

END OF SECTION 01 74 23

SECTION 01 77 00 – PROJECT CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including:

1. Substantial Completion.
2. Final Completion and Final Payment.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 32.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Submittal Procedures.
2. Final Cleaning.
3. Project Record Documents.
4. Operating and Maintenance Data/Owner Training.

1.03 SUBSTANTIAL COMPLETION

A. General: Before requesting inspection for certification of Substantial Completion, complete checklists A, B, and C, which are found in this manual. Return the signed forms to the engineer. Inspection for Substantial Completion will not be conducted until the engineer is satisfied that these requirements have been met.

B. Application for Payment: In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

1. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

C. Inspection Procedures: Upon receiving the request for inspection, the engineer will either proceed with inspection or advise the General Building Contractor of unfilled requirements. The engineer will prepare the Certificate of Substantial Completion following inspection, or advise the General Building Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The engineer will repeat inspection when requested and assure that the Work has been substantially completed. The General Building Contractor shall be responsible for hourly payments of additional site reviews made by the engineer with costs deducted from the General Building Contractor's balance.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

SUBSTANTIAL COMPLETION – CHECKLIST ‘A’

General Building Contractor Responsibilities

Prior to the General Building Contractor’s request for Substantial Completion, the General Building Contractor is responsible for the following:

- ☐ Submit a list to the engineer of incomplete items, stating reasons why each of the items is incomplete. The General Building Contractor shall stipulate a monetary value to complete each item.
- ☐ Notify the Owner 30 days prior to any insurance coverage changes. Copy the engineer on this correspondence.
- ☐ Submit all warranties, maintenance contracts, and required operating instructions to the engineer for review and distribution to the Owner. See section 01 78 23 for timing.
- ☐ Obtain the Certificate of Occupancy to allow the Owner’s full and unrestricted use of the project. General Building Contractor to check with the local zoning ordinance for required permits or certificates. Submit to the engineer for review and distribution to the Owner.
- ☐ Submit record documents that show all changes made during construction, including all drawings, specifications, and addenda. Submit to the engineer for distribution to the Owner.
- ☐ Deliver to the Owner material replacement and maintenance stock as called for in the specifications.
- ☐ Complete the keying schedule, and deliver to the Owner with properly tagged master, submaster, room and special keys. Make final changes to lock cylinders and coordinate shifting building security to the Owner.
- ☐ Instruct the owner to operate and maintain all systems and equipment. Submit completed copies of checklist C from Section 01 78 23 to the engineer.
- ☐ Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- ☐ Complete the final clean up requirements, including touch up painting. Restore all damaged finishes. Submit completed checklist B to the engineer. See Section 01 74 23.
- ☐ Submit all required guarantees, certificates of inspections, and bonds. Sign a written guarantee at the completion of the work that covers all items requiring guarantees under the specifications. Submit copies to the Owner and engineer.

To the best of my knowledge, the above list has been completed. I hereby request the engineer’s inspection for substantial completion.

General Building Contractor’s Signature

Representing

Date

Return this completed, signed form to the engineer

1.04 FINAL ACCEPTANCE

A. General: Before requesting final inspection for certification of final completion and final payment, comply with the following checklist. List exceptions in the request.

B. FINAL COMPLETION

1. General Building Contractor's Responsibilities:

- a. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
- b. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
- c. Submit a certified copy of the engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the engineer.
- d. Submit consent of surety to final payment.
- e. Submit a final liquidated damages settlement statement.
- f. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Re-inspection Procedure: The engineer will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the engineer.

1. Upon completion of re-inspection, the engineer will prepare a certificate of final completion, or advise the General Building Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance. The General Building Contractor shall be responsible for hourly payments of additional site reviews made by the engineer or engineer with costs deducted from General Building Contractor balance.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01 77 00

SECTION 01 78 23 – OPERATING & MAINTENANCE DATA/ OWNER TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for operating and maintenance manuals including the following:

1. Operating and maintenance manuals.
2. Material finish and maintenance information.
3. Owner training and instruction.

B. Related Sections:

1. Division 2-32 Sections for special operating and maintenance data requirements for specific pieces of equipment or building operating systems.
2. Division 1 Section "Submittals" for preparing shop drawings and product data.
3. Division 1 Section "Project Close out" for general closeout requirements.

1.03 SUBMITTALS

A. Initial Submittal: Submit 1 draft copy of each manual at least 21 days before requesting inspection for Substantial Completion. Refer to SUBSTANTIAL COMPLETION Checklist A, Section 01 77 00. Include a complete operation and maintenance directory. engineer will return 1 copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. engineer will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with engineer's comments. Submit 3 copies of each corrected manual within 15 days of receipt of engineer's comments.

PART 2 – PRODUCTS

2.01 MANUALS, GENERAL

- A. Organization: Organize manuals into suitable sets of manageable size.
- B. Identification: Bind data into individual binders for each manual, properly identified on front and spine. For large manuals, provide an index sheet and thumb tabs for separate categories.
- C. Binders: Provide heavy-duty, 3-ring, vinyl-covered binders, 1 to 2 inch (25 to 50 mm) thick as required to contain information, sized for 8-1/2-by-11-inch (215-by-280-mm) paper with inside pockets or pocket folders for folded sheets.
- D. Table of Contents: After the Title Page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.
- E. Content: In each manual, include information specified in individual Specification Sections and in this Section.
- F. Warranties, Bonds and Service Contracts: Provide a copy of each warranty, bond or service contract in the appropriate manual for the information of the Owner's operating personnel.
- G. Provide written data outlining procedures to be followed in the event of product failure. List circumstances and conditions that would affect validity of the warranty or bond.
- H. Responsibility: The General Building Contractor is responsible for submitting maintenance manuals for all Work. Where a manual includes information on installations by more than one contract, the Contractor who is the principal source of information shall receive information from other contractors, coordinate and collate information for a unified manual, and provide binders and submittal as specified.

2.02 OPERATION MANUALS

- A. For each major building component and its controls, include the following in the manuals for daily operations and management of the systems and equipment:
 - 1. System or equipment description with design factors and assumptions.
 - 2. Manufacturer Name.
 - 3. Model number.
 - 4. Serial number of each component.
 - 5. Emergency instructions.

6. Spare parts list.
7. Copies of specific warranties, bonds, and service contracts.
8. Wiring diagrams.
9. Recommended maintenance procedures and turn-around times.
10. Inspection and system-test procedures.
11. Copies of applicable Shop Drawings and Product Data.
12. Listing of required maintenance materials.
13. Names and addresses of sources of maintenance materials.
14. Maintenance drawings and diagrams.
15. Precautions against improper maintenance and exposure.

2.03 MATERIAL AND PRODUCT MAINTENANCE MANUALS

A. Architectural Products: Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes, as applicable:

1. Manufacturer's catalog number.
2. Size.
3. Material composition.
4. Color.
5. Texture.
6. Reordering information for specially manufactured products.

B. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.

C. Moisture-Protection and Weather-Exposed Products: Provide complete manufacturer's data with instructions on inspection, maintenance and repair of products exposed to the weather or designed for moisture-protection purposes, as applicable:

1. Applicable standards.
2. Chemical composition.
3. Installation details.
4. Inspection procedures.
5. Maintenance information.
6. Repair procedures.

2.04 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.

1. Description: Provide a complete description of each unit and related component parts, including the following:
 - a. Equipment or system function.
 - b. Operating characteristics.
 - c. Limiting conditions.
 - d. Performance curves.
 - e. Engineering data and tests.
 - f. Complete nomenclature and number of replacement parts.
2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment provide the following:
 - a. Printed operating and maintenance instructions.
 - b. Assembly drawings and diagrams required for maintenance.
 - c. List of items recommended to be stocked as spare parts.
3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:
 - a. Routine operations.
 - b. Trouble-shooting guide.
 - c. Disassembly, repair and reassembly
 - d. Alignment, adjusting and checking.
4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
 - a. Start-up procedures.
 - b. Equipment or system break-in.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Instructions on stopping.
 - f. Shut-down and emergency instructions.
 - g. Summer and winter operating instructions.
 - h. Required sequences for electric or electronic systems.
 - i. Special operating instructions.
5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
 - a. Provide as-installed color-coded piping diagrams, where required for identification.
7. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.

8. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panel boards, including the following:
 - a. Electric service.
 - b. Controls.
 - c. Communication.

PART 3 - EXECUTION

3.01 INSTRUCTING THE OWNER'S AND/OR TENANT'S PERSONNEL

A. General: Prior to final inspection, instruct the Owner's and/or Tenant's personnel in operation, adjustment, and maintenance of products, equipment and systems. Provide instruction at mutually agreed upon times.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Fire-protection systems.
2. Motorized doors.
3. Intrusion detection systems.
4. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
5. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
6. HVAC instrumentation and controls.
7. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
8. Packaged engine generators, including transfer switches.
9. Lighting equipment and controls.
10. Communication systems, including surveillance, and television equipment.

C. For equipment that requires seasonal operation, provide similar instruction during other seasons.

D. Use the operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

E. Complete Checklist C for each system requiring instruction or training, and submit to the engineer prior to requesting inspection for Substantial Completion.

**CHECKLIST 'C' - OPERATING AND MAINTENANCE INSTRUCTIONS
OWNER TRAINING & DEMONSTRATION CERTIFICATION**

Project Name: _____

Project No. _____

Owner: _____

Building Component/System

Training conducted by (Name, Company)

The General Building Contractor shall arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

- ☐ Maintenance manuals.
 - ☐ Record documents.
 - ☐ Spare parts and materials.
 - ☐ Tools.
 - ☐ Lubricants.
 - ☐ Fuels.
 - ☐ Identification systems.
 - ☐ Control sequences.
 - ☐ Hazards.
 - ☐ Cleaning.
 - ☐ Warranties and bonds.
 - ☐ Maintenance agreements and similar continuing commitments.
- ☐ As part of instruction for operating equipment, demonstrate the following procedures:
- ☐ Start-up.
 - ☐ Shutdown.
 - ☐ Emergency operations.
 - ☐ Noise and vibration adjustments.
 - ☐ Safety procedures.
 - ☐ Economy and efficiency adjustments.
 - ☐ Effective energy utilization.

I have completed the above review to the Owner's satisfaction.

Owner Signature

Representing

Date

General Building Contractor Signature

Representing

Date

Return this completed, signed form to the engineer prior to requesting Final Inspection. (Use as many forms as required by Specification Divisions 1 -32.)

END OF SECTION 01 78 23

SECTION 01 78 39 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents.

B. Project Record Documents required include the following:

1. Marked-up copies of Contract Drawings.
2. Marked-up copies of Specifications and addenda.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Submittals.
2. Project Closeout.
3. Divisions 2 through 32 Sections for specifying Project Record Document requirements for specific pieces of equipment or building operating systems.

D. Maintaining Documents and Samples: Store record documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition. Make documents available at all times for the engineer's inspections.

1.03 RECORD DRAWINGS

A. Markup Procedure: During construction, maintain a set of blue- or black-line white prints of Contract Drawings and Shop Drawings for Project Record Document purposes.

1. Mark these Drawings to show the actual installation where the installation varies from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to, the following:

- a. Dimensional changes to the Drawings.
- b. Revisions to details shown on the Drawings.
- c. Depths of foundations below the first floor.
- d. Location and depth of underground utilities.
- e. Revisions to routing of piping and conduits.
- f. Revisions to electrical circuitry.
- g. Actual equipment locations.
- h. Duct size and routing.
- i. Locations of concealed internal utilities.
- j. Changes made by change order or Construction Change Directive.
- k. Changes made following the engineer's written orders.
- l. Details not on original Contract Drawings.

2. Mark record sets with red erasable colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.

3. Mark important additional information that was either shown schematically or omitted from original Drawings.

4. Note Construction Change Directive numbers, alternate numbers, change-order numbers, supplemental instructions number, construction bulletin numbers, and similar identification.

B. Responsibility for Markup: The General Building Contractor, whether the individual or entity is the installer, subcontractor, or similar entity, shall prepare the markup on record drawings.

1. Accurately record information in an understandable drawing technique.

2. Record data as soon as possible after obtaining it. Record and check the markup prior to enclosing concealed installations.

3. At time of Substantial Completion, submit record drawings to the engineer for the Owner's records. Organize into sets and bind with durable cover sheets that include appropriate identification, including titles, dates, and other information.

1.04 RECORD SPECIFICATIONS

A. During the construction period, maintain 1 copy of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.

1. Mark the Specifications to indicate information on concealed installations that would be difficult to identify or measure and record later.

2. Upon completion of markup, submit record Specifications to the engineer for the Owner's records.
3. Each prime contractor is responsible for marking up Sections that contain its own Work.
 - a. The General Building Contractor is responsible for collecting marked-up record Sections from each of the other prime contractors. The General Building Contractor is also responsible for collating these Sections in proper numeric order with its own Sections to form a complete set of record Specifications.
 - b. The General Building Contractor is responsible for submitting the complete set of record Specifications as specified.

1.05 MISCELLANEOUS RECORD SUBMITTALS

A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the engineer for the Owner's records.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 RECORDING

A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

END OF SECTION 01 78 39

END OF DIVISION 01 – GENERAL REQUIREMENTS

41. SWEF Building, General Construction, Item SPV.0105.101.

A Description

This item consists of the general construction work for the SWEF (Safety & Weight Facility) building. The work shall be according to the applicable plans and the following specifications.

B (Vacant)

C (Vacant)

D Measurement

The department will measure SWEF Building, General Construction, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.101	SWEF Building, General Construction	LS

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

DIVISION 03 – CONCRETE

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

Delete "concrete topping" from schedule - Refer to Concrete Topping Section 03350.

Delete "exterior concrete" from schedule - Refer to Cement Concrete Paving Section

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Applicable provisions of Division 1 shall govern all work under this section.

B. Section Includes:

1. Cast-in-place concrete
2. Formwork, shoring, bracing, and anchorage
3. Concrete reinforcement, anchor bolts, waterstops and accessories
4. Installation of perimeter insulation
5. Underslab vapor retarder barrier
6. Underslab rigid insulation
7. Granular base under slab-on-grade floors

1.02 WORK INSTALLED BUT FURNISHED UNDER OTHER SECTIONS

- A. Section 05 12 00 – Structural Steel: Anchor bolts
- B. Section 07 21 13 – Board Insulation: Perimeter and underslab insulation installation.

1.03 RELATED SECTIONS

- A. Section 05 12 00 – Structural Steel: Anchor Bolts
- B. Section 07 13 00 – Waterproof Membrane System: Foundation wall waterproofing
- C. Section 07 21 13 – Board Insulation: Perimeter insulation, protection board, underslab rigid insulation
- D. Division 22 – Plumbing: Trench drain system
- E. Division 23 – HVAC: In-Slab Radiant Heating
- F. Division 26 – Electrical: In-slab and underslab conduits and electrical equipment.
- G. Section 31 23 00 – Excavation & Fill

1.03 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 318-Building Code Requirements for Reinforced Concrete.
 - 2. ACI 301-Specifications for Structural Concrete in Buildings.
- B. American Society for Testing and Material (ASTM):
 - 1. ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement.
 - 2. ASTM A497 – Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
 - 3. ASTM A615 – Deformed and Plain Billet-Steel for Concrete Reinforcement.
 - 4. ASTM C 33 - Concrete Aggregates.
 - 5. ASTM C94 – Ready-Mixed Concrete.
 - 6. ASTM C150 – Portland Cement.
 - 7. ASTM C260 – Air Entraining Admixtures for Concrete.
 - 8. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.

1.04 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures:

1. SD-02 Shop Drawings
 - a. Fabrication Drawings
 - 1) Formwork
 - 2) Reinforcing steel
 - b. Provide erection drawings for concrete formwork that show placement of reinforcement and accessories, with reference to the contract drawings. Reproductions of contract drawings are unacceptable. Electronic CAD foundation background plans will be made available to the Concrete subcontractor.
2. SD-03 Product Data
 - a. Materials for curing concrete.
 - 1) Joint filler
 2. Aggregate Materials
 - 3) Cement
 - 4) Fly Ash
 - 5) Portland Cement.
 - 6) Ready-Mix Concrete.
 - 7) Vapor retarder membrane.
 - 8) Bonding Materials.
 - 9) Concrete Curing Materials
 - 10) Reinforcement
 - 11) Liquid Chemical Floor Hardener.
 - 12) Waterstop
3. SD-04 Samples
 - a. Submit the following samples:
 - 1) Three samples of waterstop, 12 inch long, including samples of straight run splices and prefabricated corner sections.
4. SD-05 Design Data
 - a. Concrete mix design
 - 1) Fifteen (15) days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, ground slag, and admixtures; and applicable reference specifications.
 - 2) Provide mix proportion data using at least three different water-cement ratios for each type of mixture, which produce a range of strength encompassing those required for each class and type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only

materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the A/E. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted.

3) Submit additional data regarding concrete aggregates if the source of aggregate changes. Submit copies of the fly ash, and pozzolan test results, in addition. The approval of fly ash, and pozzolan, test results must be within 6 months of submittal date.

1.05 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Comply with latest provisions of ACI 301, "Specifications for Structural Concrete for Buildings," ACI 318, "Building Code Requirements for Reinforced Concrete," and CRSI "Manual of Standard Practice," except where more stringent requirements are indicated.

1.06 TESTING AND QUALITY CONTROL SERVICES

A. Selection and Payment

1. The General Building Contractor shall employ and pay for services of an independent testing laboratory to perform specified inspection and testing.

2. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work according to requirements of the Contract Documents.

B. Quality Assurance

1. Laboratory: Authorized to operate in the State of Wisconsin.

C. Contractor Submittals

1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of registered engineer that will be responsible for the testing and submittal of test results.

2. Submit test reports to the Architect's office.

D. Laboratory Responsibilities

1. Perform sampling and testing of concrete work as described under this section, Art. 3.09 – Field Quality Control.

PART 2 - PRODUCTS

2.01 FORM MATERIALS:

A. General: Furnish form materials according to ACI 301 with sufficient stability to withstand pressure of placed concrete without bow or deflection. Forms shall be of plywood, metal framed plywood faces or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Forms for Exposed Concrete Surfaces: Suitable panel-type material to provide continuous, straight, smooth, exposed surfaces. New plywood complying with U.S. Product Standards PS-1, Plyform Class I, B-B Concrete Form Plywood, B-Matte MDO by Simpson, 5/8" or 3/4" thick without defects, mill oiled and edge sealed or wood forms lined with 3/16" tempered pressed wood or 1/4" thick plywood B-B conforming to EXT-DFPA as large as possible to minimize joints.

C. Formed Surfaces Concealed From View

1. Wood: Clean straight lumber dressed on face and edges, nominal 1" thickness or plywood 5/8" or 3/4" thick conforming to EXT-DFPA or metal forms smooth and as large size as possible.

D. Form Ties

1. For Unexposed Concrete: Adjustable length removable or snap-off type fabricated to leave holes no larger than 1" in diameter in face of concrete with breakpoint 1" or more from surface.
2. For Exposed Concrete: Snap-off type (break point 1" or more from surface) with plastic cones added to form a 1-1/4" diameter, 1-1/2" deep recess around tie which shall be grouted flush to match adjacent concrete surface.
3. Wire ties or site fabricated ties will not be permitted.
4. Form Release Agent: Commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, nor impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound. Material shall be appropriate for environmental conditions encountered.

2.02 GRANULAR BASE UNDER SLAB-ON-GRADES

A. Provide 6 inches of clean sand and gravel having less than 5% particles passing the #200 sieve. Compact to a minimum of 95% of its' maximum standard Proctor density (ASTM D 698).

2.03 REINFORCING MATERIALS

A. Clean, free of loose rust, mill scale, dirt, ice, etc., as follows:

B. Deformed Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.

C. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M

D. Steel Bar Mats: ASTM A 184/A 184M, assembled with clips.

1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60, deformed bars.

2. Steel Reinforcement: ASTM A 706/A 706M, deformed bars.

E. Plain-Steel Wire: ASTM A 82, as drawn.

F. Welded Wire Fabric: ASTM A 185, 65,000 psi yield strength, fabricated from as-drawn steel wire into flat sheets.

G. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

2.04 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Epoxy-Coated Joint Dowel bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

2.05 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type 1.

B. Fly Ash: Class C, ASTM 618.

C. Aggregates: ASTM C 33, except local aggregates of proven durability may be used when acceptable to Architect. Normal weight coarse aggregate to be crushed stone or gravel. Fine aggregate shall be natural sand.

1. For exterior exposed surfaces (slabs, walks, platforms, ramps, steps, etc.) do not use fine or coarse aggregates containing spalling-causing deleterious substances (chert). Submit tests on aggregate substantiating this requirement.
2. Water: Potable (drinkable).

2.06 ADMIXTURES:

A. General: Admixtures are limited to the following, unless approved by Architect. Provide admixtures that contain less than 0.1 chloride ions.

1. Air-Entraining Admixture: ASTM C 260. Materials shall be compatible with other required admixtures. Subject to compliance with requirements provide one of the following:
 - a. Daravair, W. R. Grace & Company.
 - b. Micro-Air, Master Builders, Incorporated.
 - c. Sika AER, Sika Corporation.
 - d. Synthetic Air, Euclid Chemical Company.
2. Water-Reducing, Retarding, and Accelerating Chemical Admixtures: ASTM C 494. Type A. Subject to compliance with requirements provide one of the following:
 - a. Eucon WR 75, Euclid Chemical Company.
 - b. Pozzolith 220N, Master Builders, Incorporated.
 - c. WRDA with Hycol, W. R. Grace & Company.
3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F, containing no chloride ions.
 - a. Eucon 37, Euclid Chemical Company.
 - b. Rheobuild 1000, Master Builders, Incorporated.
 - c. Sikament, Sika Corporation.
 - d. WRDA 19, W.R. Grace & Company.

4. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E, containing no chloride ions.
 - a. Accelguard 80, Euclid Chemical Company.
 - b. Daraset, W.R. Grace & Company.
 - c. Pozzolith 500, Master Builders, Incorporated.
5. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, containing no chloride ions.
 - a. Eucon Retarder 100, Euclid Chemical Company.
 - b. Daratard-17, W.R. Grace & Company.
 - c. Plastiment, Sika Corporation.
 - d. Pozzolith 100XR, Master Builders, Incorporated.
6. Viscosity Modifying Admixture
 - a. Polychem VMA, General Resource Technology, Inc., Eagan, MN
7. Waterproofing Admixture
 - a. Xypex C-500, XYPEX Chemical Corporation, Richmond, BC, Canada.
 - b. Used as an integral waterproofing admixture at the time of batching.
 - c. Applicable to the following below-grade foundation walls:
 - 1) Scale Tunnel 001
 - 2) Stair 002
 - 3) Recessed Inspection Pits 125 & 126
 - 4) Break testing pits in Inspection 124

2.07 RELATED MATERIALS

A. Expansion Joint Filler

1. Flexible, lightweight, non-staining, polyethylene, closed-cell compressible foam compatible with cold-applied sealants, caulks and hot-pour joint sealants. Foam expansion joint filler shall have a pre-scored removable strip to provide a uniform sealing reservoir.
2. Complying with:
 - ASTM D 1622, 2.0 lbs/cu. ft. density
 - ASTM D 3575, 55 psi tensile strength
 - ASTM D3575 0.5% vol. max. water absorption
3. Thickness: Provide 1/2" thickness where slabs abut walls, columns, or other vertical surfaces.
4. Manufacturer: W.R. Meadows 'Deck-O-Foam'

B. Waterstop

1. Provide 4" wide x 3/16" thick flat ribbed flexible PVC waterstop.
2. Manufacturers
 - a. Greenstreak Style No. 781 or equivalent profile as manufactured by BoMetals, Inc., Powder Springs, GA.
3. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.
4. Performance Requirements as follows:

Property	Test Method	Required Limits
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lbs/in (35 kN/m) min.
Ultimate Elongation	ASTM D 638	350% min.
Tensile Strength	ASTM D 638	2000 psi (13.78 Mpa) min.
Low Temperature Brittleness	ASTM D 746	No Failure @ -35° F (-37° C)
Stiffness in Flexure	ASTM D 747	600 psi (4.13 Mpa) min.
Specific Gravity	ASTM D 792	1.45 max.
Hardness, Shore A	ASTM D 2240	79 $\pm$ 3
Tensile Strength after accelerated extraction	CRD-C 572	1850 psi (11.03 Mpa) min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalies after 7days: Weight Change/ Hardness Change	CRD-C 572	Between -0.10% / +0.25% +/- 5 points

5. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.
6. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
7. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.

C. Underslab Vapor Retarder Membrane

1. 15-mil sheet type plastic membrane meeting all requirements of ASTM E1745 Classes A, B & C.
2. Water Vapor Permeance Rating (ASTM F 1249): 0.018

3. Tensile Strength (ASTM E 154, Section 9): 84 lbs.-Force/inch.
4. Puncture Resistance (ASTM D 1709, Method B): 4,335 grams
5. Manufacturers
 - a. W.R. Meadows, Hampshire, IL: Perminator Underslab Vapor-Mat
 - b. Reef Industries, Houston, TX: Griffolyn 15 mil
 - c. Raven Industries, Sioux Falls, SD: Vapor Block 15

D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

E. Moisture-Retaining Cover: Waterproof paper, polyethylene film or polyethylene-coated burlap, complying with ASTM C 171. Use this method for all slabs on grade. Seal all joints, penetrations and perimeters. Retain and protect cover from damage for a minimum of seven (7) days. Add moisture daily to maintain surface in a damp condition.

F. Membrane-Forming Curing Compound: ASTM C-1315 Type I, Class A. Moisture loss not more than 0.40 kg/sq. meter when applied at 300 sq. ft./gal.

1. Concrete Contractor to coordinate with and receive approval of Finish Flooring Contractor, of compatibility of curing compound with flooring materials and adhesives prior to application.

2. Products: Subject to compliance with requirements, provide one of the following:

- a. Kure-N-Seal 25LV by BASF Incop.
- b. Dayton J-22UV by Dayton-Superior
- c. Kure and Seal 1315 by TK Products

G. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Aqua-Cure, Euclid Chemical Co.
- b. VoComp-20, W.R. Meadows, Inc.
- c. Dayton J-18 Safe Cure & Seal.
- d. TK-Kure and Seal WB, TK Products

H. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Tri-Film by TK Products
2. Dayton J-74 Sure-Film.

I. Sealer: Where sealer ("sealed slab") is noted on Room Finish Schedule. Apply per Manufacturer's instructions and at manufacturers recommended application rates. Provide manufacturers five (5) year guarantee against dusting.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. TK-5329 Floor Hardener and Densifier by TK-Products
- b. Ashford Formula by Curecrete Chemical Company
- c. Sealhard by WR Meadows

2.08 MIX PROPORTIONING

A. Ready-Mix Concrete: Measure, mixed and delivered according to ASTM C-94.

B. Mix Design Schedule:

Use	Min. Compress. Strength @ 28 days	Slump (Before plasticizer)	Max Aggr Size	Min lbs of cement per C.Y.	Air Entrain. % +/- 1/2%	W/C Ratio
Footings	3,000 PSI	5"	1 1/2"	423 lb	4.5%	.68
Walls/Piers	4,000 PSI	4"	3/4"	541 lb	None	.57
Interior Office Slab-On- Grade	4,000 PSI	3"	1 1/2"	541 lb	None	.57
Interior Traffic Slab-On- Grade	4,000 PSI	3"	1 1/2"	541 lb	6.0%	.45
Exterior Slab- On-Grade	3,500 PSI	3"	3/4"	517 lb	6.0%	.48
Bond Beams	3,000 PSI	4"	3/8"	517 lb	None	.68

C. Air entrained concrete: Use for all exterior walls, exterior slabs, walks, platforms, ramps, steps and all other concrete exposed to freezing and thawing.

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Concrete without admixtures: 3 and 4 inch slump plus 1 inch and minus 1/2 inch.
 2. Concrete without admixtures: 5 inch slump plus or minus 1 1/2 inch and minus 1 inch.
 3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches plus or minus 1 1/2 inches.
- E. Cement Content: 1.5 parts of Class C fly ash may be substituted for 1.0 parts of cement up to a maximum of 20% of the cement content or 100 pounds of fly ash, whichever is most restrictive of fly ash content.
- F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.
- G. Use water-reducing, accelerating, and retarding admixtures that have been tested and accepted in mix designs in strict compliance with manufacturer's directions.
- H. Job-Site Mixing: Use drum-type batch machine mixer, mixing not less than 1-1/2 minutes for 1 cu. yd. or smaller capacity. Increase mixing time at least 15 seconds for each additional cu. yd.

PART 3 - EXECUTION

3.01 FORMWORK

- A. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Select form materials to obtain required finishes.
1. Maintain formwork tolerances and surface irregularities within ACI 347 limits, Class A tolerances for concrete exposed to view and Class C tolerances for other concrete surfaces.
 2. Provide openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms.
 3. Clean and adjust forms prior to concrete placement. Apply form-release agents or wet forms as required. Retighten forms during concrete placement, if required, to eliminate mortar leaks.

3.02 REINFORCEMENT

A. Accurately position and support reinforcement. Locate and support reinforcement to maintain minimum cover with metal chairs, runners, bolsters, spacers, and hangers as required. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

1. Install welded wire fabric in lengths as long as practicable; lap at least one full mesh and lace splices with wire.

3.03 JOINTS

A. Locate and install construction, isolation, and control joints as indicated or required. Locate construction joints so they do not impair strength and appearance of structure. Place isolation and control joints in slabs-on-ground to stabilize differential settlement and prevent random cracking. Provide compressible expansion joint filler material where slabs abut walls, columns or other vertical surfaces.

3.04 INSTALLATION OF EMBEDDED ITEMS

A. Set and build anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting diagrams, templates, and instructions provided by others for locating and setting.

3.05 CONCRETE PLACEMENT:

A. Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," for placing concrete in a continuous operation within planned joints or sections. Do not begin concrete placement until other affected work is completed.

1. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping so that concrete is worked around reinforcement and other embedded items and into forms.
2. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.
 - a. In cold weather comply with ACI 306.
 - b. In hot weather comply with ACI 305.
 - 1) Place no concrete when temperatures exceed 90 degrees F.
3. Protect adjacent finished materials/surfaces from concreting operations. Repair/replace any damaged surfaces/materials at no cost to Owner.

3.06 CONCRETE SLAB FLATNESS AND LEVELNESS TOLERANCES

A. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10-foot long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4 inch.

B. Concrete floor slabs surrounding floor drains shall be sloped $\frac{1}{4}$ " per foot from "finished floor elevation" unless noted otherwise.

3.07 FINISH OF FORMED SURFACE

A. Smooth-Formed Finish: Fill voids and rub smooth all concrete surfaces exposed to view and surfaces to be covered with a coating or covering material applied directly to concrete. Repair and patch defective areas, remove fins and other projections completely and rub smooth.

B. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, paint, or other thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.

2. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances listed under par. 3.06 above. Grind smooth surface defects that would telegraph through applied floor covering system.

C. Trowel and Fine Broom Finish: Where ceramic tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

D. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.08 CURING / SEALING

A. Moist Curing

1. All slabs shall be sheet cured per ACI 308 2.3.1 Plastic Film or 2.3.2 Reinforced Paper only for 7 days after placement. Curing system joints shall be sealed and moisture added daily to maintain concrete surface in a damp condition.

2. Insulating blankets used during cold weather do not need sealed joints as long as concrete surface is damp.

3. After 7 days of moist curing, apply liquid membrane system.

B. Liquid Membrane Curing

1. All concrete surfaces not specified to receive other curing shall be liquid membrane cured per ACI 308 2.3.3. If no rate of coverage is indicated by the manufacturer, apply at a minimum rate of 200 square feet per gallon. The maximum rate of coverage, even if manufacturer's recommendation indicated greater coverage, shall be 300 S.F. per gallon.
2. Upon substantial completion, clean floors and apply one additional coat of Liquid Membrane Type 2 concrete hardener to floors not scheduled to receive floor coverings.

3.09 FIELD QUALITY CONTROL

A. Coordinate sampling and testing during concrete placement by General Building Contractor's independent testing agency as follows:

B. Site Testing

1. Testing firm will take cylinders and perform slump and air entrainment tests according to ACI 301. Refer to Section 03 30 00 – Cast-In-Place Concrete for testing requirements.
2. Three concrete test cylinders will be taken for every 50 or less cu. yds. of concrete placed every day. One additional test cylinder will be taken during cold weather and be cured on site under same conditions as concrete it represents.
3. One slump test will be taken for each set of test cylinders taken.

C. Contractor Responsibilities

1. Cooperate with laboratory personnel, and provide access to the Work. Notify testing laboratory in advance of work to be tested to schedule field inspection and material sampling.
2. This testing does not relieve contractor of responsibility of providing concrete in compliance with specifications. Contractor may perform additional testing as necessary to ensure quality of concrete.
3. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - a. Slump: ASTM C 143; one test at point of discharge for each load of each type of concrete. Conduct test prior to the addition in the field of any super-plasticizer. If a slump test fails, immediately retest same batch. If second test fails, concrete is rejected. Conduct additional tests when concrete consistency seems to have changed.

- b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete. If air content test fails, immediately retest same batch. If second test fails, concrete is rejected.
 - c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 - d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store three (3) cylinders for laboratory-cured test specimens and one (1) for field-cured test specimen.
 - e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one field cured specimen retained in reserve for later testing if required.
4. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
5. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
7. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
8. Tests shall include compression yield, air content and slump. Results shall be reported in writing to Architect, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

10. Additional Tests: The testing agency shall take additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 03 30 00

SECTION 03 41 00 - PRECAST CONCRETE HOLLOW CORE PLANK

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Applicable provisions of Division 1 shall govern all work under this section.
- B. Section Includes:
 - 1. Precast concrete hollow core plank.
 - 2. Connections and bearing strips.
 - 3. Grouted precast plank joints.

1.02 RELATED SECTIONS

- A. Section 04 20 00- Unit Masonry.
- B. Section 05 10 00 – Structural Steel

1.03 REFERENCES

- A. Reference Specifications: Comply with recommended practices and procedures of the referenced specification standards and with the modification as specified herein.
- B. Prestressed Concrete Institute (PCI):
 - 1. MNL-116S Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
 - 2. MNL-118 Manual for Inspection of Prestressed Concrete.
 - 3. MNL-123 Manual on Design of Connections for Precast Prestressed Concrete.
 - 4. MNL-124 Design for Fire Resistance of Precast Prestressed Concrete.
 - 5. MNL- 126 Manual for Design of Hollow Core Slabs.
 - 6. MNL-120 Handbook – Precast and Prestressed Concrete
- C. American Concrete Institute (ACI):
 - 1. ACI 318-Building Code Requirements for Reinforced Concrete.
 - 2. ACI 301-Specifications for Structural Concrete in Buildings.
- D. American Welding Society (AWS):
 - 1. AWS D1.1-Structural Welding Code for Structural Steel.
 - 2. AWS D1.4-Structural Welding Code for Reinforcing Steel.
 - 3. AWS B2.1 – Specification for Welding Procedure & Performance Qualifications

1.04 SUBMITTALS

A. SD-02 Shop Drawings: Showing layout, dimensions, and identification of precast units; details of inserts, connections, joints, superimposed design loads, camber for each unit mark and special reinforcement and lifting devices necessary for handling and erection.

B. SD-05 Prepare calculations and shop drawings under the direct supervision of a structural engineer experienced in the design of products specified and registered in the State of Wisconsin.

1. State Submittals: Provide six (6) copies of shop drawings and design calculations that have been signed and stamped by a professional engineer licensed in the State of Wisconsin. Precast plank manufacturer shall include 'component submittal' review Fee made out to 'DSPS'.

C. SD-08 Fabricator's Installation Instruction: Indicate special procedures required for installation and or temporary shoring requirements.

1.05 DESIGN REQUIREMENTS

A. Design Standards: Comply with ACI 318-Building Code Requirements for Reinforced Concrete and MNL- 126 Manual for Design of Hollow Core Slabs.

B. Quality Control Standards: Comply with PCI MNL-116S Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products, except that camber tolerance shall be not more than or less than 1/4 inch of the camber indicated on the approved shop drawings.

C. Fire-resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring fire-resistance classification, provide units tested and listed by PCI MNL-124 Design for Fire Resistance of Precast Prestressed Concrete.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast units to project site in such quantities and at such times to assure continuity of installation. Store units to prevent cracking, warping, staining, or other damage. Lift and support precast units only at designated lifting or supporting points.

PART 2 - PRODUCTS

2.01 FABRICATORS

A. Fabricator Qualifications: A qualified fabricator firm shall participate in PCL's Plant Certification program and is designated a PCI plant for Group C, Category C1. Approved fabricators included but are not limited to the following:

1. County Concrete
2. Spancrete Industries, Inc.
3. Mid-States Concrete Industries, Inc.

2.02 MATERIALS

A. Form Materials: Provide formwork of sufficient strength to withstand pressures due to concrete operations and, when prestressed, pretensioning and detensioning operations. Maintain formwork to provide precast units of the size, shape, lines, and dimensions indicated, with continuous, straight, smooth surfaces free of honeycomb or other deficiencies.

1. Provide formed openings in precast units for holes larger than 10" in diameter.

B. Reinforcing Materials: As follows:

1. Reinforcing Bars: ASTM A 615, Grade 60.
2. Galvanized Reinforcing Bars: ASTM A 767, Class 2.
3. Steel Wire: ASTM A 82.
4. Prestressing Tendons: ASTM A 416, uncoated, 7-wire stress-relieved strand, Grade 270 or 250 unless otherwise indicated.
5. Steel Inserts and Connections: ASTM A 36, galvanized after fabrication where exposed to weather.

C. Concrete Materials: As follows:

1. Portland Cement: ASTM C 150, type as required.
2. Aggregates: ASTM C 33, except local aggregates of proven durability may be used when acceptable to Architect.
3. Water: Potable.

D. Air-Entraining Admixture: ASTM C 260.

E. Water-Reducing Admixture: ASTM C 494, type as required.

F. Mix Proportions and Design: Proportion mixes by either laboratory trial batch or field experience method.

1. Submit written report to Architect for each proposed concrete mix at least 15 days prior to start of work. Do not begin precast concrete production until mixes have been reviewed and are acceptable to Architect.
2. Mix designs may be adjusted when material characteristics, job conditions, weather, test results, or other circumstances warrant. Do not use revised concrete mixes until submitted to and accepted by Architect.

3. Use air-entraining admixture in concrete.
4. Cure compression test cylinders by same procedures as used in manufacturing process for precast units.

G. Produce standard-weight concrete consisting of Portland cement, aggregates, admixtures, and water to produce the following properties.

1. Compressive strength not less than 5000 psi at 28 days. Total air content not less than 4 percent, nor more than 6 percent.

2.03 FABRICATION

A. Installation of Embedded Items: Set and build into precast units anchorage and connection devices, and other items required for other work that is attached to or supported by precast units.

B. Concrete Placement: Comply with PCI MNL 116.

C. Place concrete in continuous operation to prevent formation of seams or planes of weakness in precast units, using internal and external vibration for consolidation.

D. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into forms.

E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.

F. Provide permanent markings in precast units to identify pickup points and orientation in structure. Imprint date of casting on each unit where it will not show in finished structure.

G. Cure precast units by low-pressure stream, steam vapor, radiant heat and moisture, or other similar process.

H. Delay detensioning of prestressed units until concrete has attained at least 75 percent of design ultimate compressive strength.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prepare support devices for the erection procedure and temporary bracing.

3.02 ERECTION

- A. Erection: Do not erect precast units until concrete has attained its design ultimate compressive strength.
- B. Place units plumb, level, and in alignment. Provide temporary supports and bracing as required to hold units in position until permanently connected. Set units on appropriate bearing pads where required.
- C. Provide necessary bolts, clips, hangers, and other accessories required for installation of precast units, galvanized after fabrication.
- D. Anchor units in final position by bolting, welding, and grouting, as indicated.
 - 1. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.
 - 2. At welded connections, apply touch-up coat of primer on painted surfaces and galvanizing repair material on galvanized surfaces.
- E. Performance Evaluation: In addition to Quality Control tests and evaluations, precast units may be rejected for any of the following:
 - 1. Defects as listed in PCI MNL-116.
 - 2. Damaged during construction operations.
 - 3. Excessive dimensional variations.
- F. Repair or replace unacceptable precast units as directed by Architect.

END OF SECTION 03 41 00

END OF DIVISION 03 – CONCRETE

DIVISION 04 – MASONRY

SECTION 04 05 13 – MASONRY MORTAR & GROUT

PART 1 -GENERAL

1.01 SUMMARY

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Section Includes:
 - 1. Mortar
 - 2. Grout
 - 3. Non-shrink grout

1.02 RELATED SECTIONS

- A. Section 04 20 00 - Unit Masonry: Unit Strength Tests
- B. Section 05 12 00 - Structural Steel: Column Base Plates

1.03 REFERENCES

- A. Mortar:
 - 1. ASTM C91 Standard Specification for Masonry Cement.
 - 2. ASTM C144 Standard Specification for Aggregate for Masonry Mortar.
 - 3. ASTM C150 Standard Specification for Portland Cement.
 - 4. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purpose.
 - 5. ASTM C270 Standard Specification for Mortar for Unit Masonry.
 - 6. ASTM C595 Standard Specification for Blended Hydraulic Cements.
 - 7. ASTM C780 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 8. ASTM C926 Standard Specification for Application of Portland Cement-Based Plaster.
 - 9. ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete.
 - 10. ASTM C1329 Standard Specification for Mortar Cement.
- B. Grout:
 - 1. ASTM C143/C143M Standard Test Method for Slump of Hydraulic Cement Concrete
 - 2. ASTM C150 Standard Specification for Portland Cement.

3. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purpose.
4. ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
5. ASTM C404 Standard Specification for Aggregates for Masonry Grout
6. ASTM C476 Standard Specification for Grout for Masonry.
7. ASTM C595 Standard Specification for Blended Hydraulic Cements.
8. ASTM C1019 Standard Test Method for Sampling and Testing Grout
9. ASTM C1157 Standard Performance Specification for Hydraulic Cement

C. Non-Shrink Grout:

1. ASTM C 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
2. ASTM C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars.
3. ASTM C 138 Test Method of Unit Weight, Yield and Air Content of Concrete.
4. ASTM C 157 Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
5. ASTM C 185 Test Method for Air Content of Hydraulic Cement Mortar.
6. ASTM C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency.

D. American Concrete Institute (ACI):

1. ACI 530-05/ASSCE 50-5/TMS 402/05 Building Code Requirements for Masonry Structures.
2. ACI 530.1 -05 /ASCE 6-05/TMS 602/05 Specifications for Masonry Structures.

1.04 SYSTEM DESCRIPTION

- A. Design and Performance Requirements: Provide mortar and grout mixes which have been selected, manufactured, mixed and installed to comply with the standards referenced herein.
- B. Quality Control Testing: Refer to Section 04 20 00 for testing requirements.

1.05 SUBMITTALS

- A. Submit the following according to Section 01 33 00 – Submittal Procedures:
 1. SD-03 Product Data: Submit manufacturer's product data and installation instructions.

2. SD-04 Samples: Submit two samples of selected mortar color.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Storage and Protection:
 1. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
 2. Store materials in a dry location, on palettes or other above ground platform set on top of tarp or similar vapor barrier plastic membrane. Wrap with a waterproof tarp or other suitable covering.

1.07 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 1. Do not build or apply mortar products on frozen substrates.
 - a. Remove and replace unit masonry damaged by frost or freezing conditions.
 2. Take special care when constructing in extremely hot or cold weather. Comply with the following standards:
 - a. ACI 530-05/ASSCE 50-5/TMS 402/05 Building Code Requirements for Masonry Structures.
 - b. ACI 530.1 -05 /ASCE 6-05/TMS 602/05 Specifications for Masonry Structures.

PART 2 - PRODUCTS

2.01 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Cement: ASTM C 1329.
- D. Masonry Cement: ASTM C 91.

- E. Aggregate for Mortar: ASTM C 144, Fine Type, except for joints less than $\frac{1}{4}$ inch use aggregates graded with 100 percent passing a No. 16 sieve.
- F. Mortar Type:
1. Type 'M' use for below grade masonry.
 2. Type 'S' use for exterior and interior bearing walls.
 3. Type 'N' use for interior partitions.
- G. Mortar Compressive Strength:
- | | | | |
|----|--------|--------|-----------|
| 1. | Type M | 28 day | 2,500 psi |
| 2. | Type S | 28 day | 1,800 psi |
| 3. | Type N | 28 day | 750 psi |
- H. Pigmented Mortar
1. Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use at ground faced CMU locations.
 2. Manufacturers
 - a. Solomon Colors, Inc.
 - b. LaFarge Corp.
 - c. Western Lime & Cement Co.
 3. Color(s): To be selected by Architect from manufacturer's standard range of colors.
- I. Aggregates for Grout: ASTM C 404, Course Type grout may be used in grout spaces in brick masonry, 2" or more in horizontal dimensions where no steel is in the grout space, and in the cells in block construction that are 4" or more in both horizontal dimensions. Fine Type grout should be used if the cavity space is smaller than noted above.
- J. Grout Compressive Strength: Grout shall have minimum compressive strength of 3000 psi at 28 days when proportion according to ASTM C 1019.
- K. Grout Slump: The grout shall be mixed to a slump of 8 to 11 inches as determined by ASTM C 143/C 143M.
- L. Non-Shrink Grout: ASTM C1107, nonmetallic aggregate grout, shrink-resistant, factory packaged, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30 minute working time.
1. Performance Specifications:
 - a. Flow: ASTM C939
 - b. Setting Time: ASTM C191

c. Compressive Strength: ASTM C109

1 day 1,000 psi

3 day 2,500 psi

7 day 3,500 psi

28 day 5,000 psi

2. Manufacturers:

a. The QUIKRETE Companies, Atlanta, GA; Commercial Grade FastSet Non-Shrink Grout #1585-09

b. CTS Cement Manufacturing Corp., Cypress, CA; 'Rapid Set Cement All'

M. Integral Liquid Polymeric Water-repellent Mortar Admixture:

1. Description: Integral liquid polymeric admixture, mixed with mortar during mixing, capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria found in ASTM E 514-74: no decrease in concrete masonry bond strength or compressive strength of prisms when compared to a control when tested according to ASTM C1357 and ASTM C 1314 respectively.

2. Locations: Provide water repellent mortar admixture at all locations of exterior exposures and/or where water-repellent units are specified.

N. Water: Potable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions:

1. Verify that site conditions are acceptable for use of mortar mixes.

2. Do not proceed with use of mortar mixes until unacceptable conditions are corrected.

3.02 MIXING

A. Mix mortar using a mechanical mortar mixer to ensure homogeneity and workability. Hand mixing of the mortar is permitted only with written approval of the Architect.

B. Use clean, potable water, add the maximum amount consistent with optimum workability. Maintain a uniform water/cement ratio.

- C. Rinse out mixer following each batch and at the end of the day, thoroughly rinse the mixer to avoid contamination of future mortar batches.
- D. Retemper mortar by adding mixing water only to replace water lost due to evaporation. Do not retemper colored mortars.
- E. Discard mortar 2.5 hours after initial mixing.

3.03 INSTALLATION

A. Mortar:

- 1. Tool mortar joints when surface is thumbprint hard.
- 2. Keep tooling time consistent.
- 3. Do not strike joint too early or too late in order to maintain color consistency.
- 4. Mortar Joint Profiles: Refer to Section 04 20 00.
- 5. Cure mortar a minimum of 28 days.

B. Grout:

- 1. Install grout according to manufacturer's instructions.
- 2. Work grout into masonry cores and cavities to eliminate voids.
- 3. Grout hollow metal door and borrowed lite frames where installed in masonry openings.
- 4. For masonry core fill grout applications, comply with the requirements of ASTM C926.

C. Non-Shrink Grout:

- 1. Place non-shrink grout using traditional methods. Place, consolidate and screed quickly to allow maximum finishing time. Consolidate to eliminate air voids. Do not wait for bleed water, apply finish as soon as possible.
- 2. On flat work, install full depth sections and progress horizontally, do not install in layers.
- 3. Do not install on frozen surfaces.
- 4. Curing: Water cure as soon as the surface has lost its moist sheen. Keep exposed surfaces wet for a minimum of 1-hour.

3.05 CLEANING

A. Cleaning Method:

- 1. Clean mortar only with potable water or dry brush.
- 2. Clean masonry with the least aggressive cleaning solution and technique possible.

3. Comply with cleaning procedure and recommendations of the manufacturers of both the cleaning solution and the unit masonry.
4. Utilize the same cleaning procedure on the sample panel at selection and during construction.

3.06 PROTECTION

- A. Protect installed work from damage due to subsequent activity on the site.

END OF SECTION 04 05 13

SECTION 04 20 00 – UNIT MASONRY

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section Includes
 - 1. Concrete masonry units
 - 2. Reinforcement, anchorage, flashings and masonry accessories
 - 3. Cavity wall insulation
 - 4. Mortar and grout placement.
 - 5. Field applied sealer over ground faced CMU surfaces.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03 41 00 – Precast Concrete Hollow Core Plank
- B. Section 04 05 13 – Masonry Mortar & Grout
- C. Section 05 50 00 – Metal Fabrications: Loose Steel Lintels
- D. Section 07 21 19 – Foamed Masonry Core Fill
- E. Section 08 11 13 – Metal Doors & Frames: Door frames set in masonry openings.

1.03 REFERENCES

- A. Unit Masonry Standard: Comply with recommended practices and procedures of the referenced specification standards and with the modifications as specified herein.
- B. American Concrete Institute (ACI):
 - 1. ACI 530-05/ASSCE 50-5/TMS 402/05 Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1 -05 /ASCE 6-05/TMS 602/05 Specifications for Masonry Structures.

C. American Society for Testing and Materials (ASTM)

1. ASTM C 140 Test Methods of Sampling and Testing Concrete Masonry Units and Related Units.
2. ASTM C 90 Specification for Load Bearing Masonry Units.
3. ASTM A 615/A 615/M Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
4. ASTM A 951 Specification for Masonry Joint Reinforcement.
5. ASTM A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement.
6. ASTM A 653/A 653/M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures:

1. SD-02 Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.
2. SD-03 Product Data: For each different masonry unit, accessories, integral mortar water repellent and other manufactured product specified.
3. SD-04 Samples for selection of the following:
 - a. Full-sized unit masonry samples showing the full range of colors and textures available for each different exposed masonry unit required.
 - b. Colored masonry mortar samples showing the full range of colors available.
 - c. Weep holes/vents.
 - d. Through-wall flashing.
4. SD-05 Mix Designs: From the Material Supplier, submit mix designs in compliance with the strength requirements of the construction documents, for the following:
 - a. Mix designs for each mortar type, indicating the proportions of ingredients in compliance with the proportion specification of ASTM C 270.
 - b. Mix designs for each grout type, indicating the proportion of ingredients in compliance with the proportion requirements of ASTM C 476.

5. SD-06 Material Test Reports: From a qualified independent Testing Agency, verification of compliance with the compressive strength requirements for concrete masonry, mortar bed joints and grout mixes according to the Unit Strength Method as follows;
 - a. Concrete Masonry Test: Determine the compressive strength of masonry based on the strength of the unit and the type of mortar specified using Table 2 of the Specifications for Masonry Structures, with the following articles to be met;
 - b. Units conform to ASTM C 90 and are sampled and tested according to ASTM C 140.
 - c. Thickness of the bed joints does not exceed 5/8 inches.
 - d. For grouted masonry, the grout compressive strength equals f'_m , but is not less than 3,000 psi and is tested to verify compressive strength according to ASTM C 1019.

1.05 FIRE PERFORMANCE CHARACTERISTICS

- A. Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.06 STRUCTURAL PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (f'_m) at 28 days.
 1. For Concrete Unit Masonry: $f'_m = 2,000$ psi. (based on net area)

1.07 QUALITY ASSURANCE

- A. The General Building Contractor shall hire an independent testing agency to assure quality assurance compliance as stated in ACI 530.1 -05 /ASCE 6-05/TMS 602/05 Specifications for Masonry Structures, Table 4 – Level 2 Quality Assurance and as specified herein.
- B. Field-Constructed Mock-Ups: Prior to installation of unit masonry, erect sample wall panels to further verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work:
 1. Locate Mock-ups on site in locations as directed by Supervising Professional.

2. Build mock-ups for the following types of masonry in sizes of approximately 6 feet long by 4 feet high by full thickness, including face and backup wythes as well as accessories.
 - a. Typical exterior concrete masonry wall with window opening return and banding course.
 3. Notify Supervising Professional one week in advance of the dates and times when mock-ups will be erected.
 4. Protect mock-ups from the elements with weather-resistant membrane.
- C. Testing Agency Services: Sample and test according to the Unit Strength Method as specified for the project to determine the compressive strength of clay masonry and concrete masonry. Conduct one set of test prior to the start of construction and one set of tests for each addition 5,000 square feet of masonry walls.
- D. Inspection Agency Services: Prepare inspection reports to verify the following items are in compliance. Prepare one inspection report as masonry construction begins and one additional report for each 5,000 square feet of masonry walls.
1. Proportions of site prepared mortar types, complies with approved mix designs.
 2. Construction of mortar joints comply with specified thickness.
 3. Location of reinforcement complies with approved shop drawings, including bar lap length and bar spacing.
 4. Proportion of site prepared grout types, complies with approved mix designs.
 5. Observe grout space to be free of obstructions for grout placement.
 6. Observe consolidation of grout placement to ensure that methods used will produce cores grouted solid and without voids throughout the height of the masonry unit.
 7. Observe preparation of grout specimens, mortar specimens and or prisms.

1.08 PROJECT CONDITIONS

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:
1. Cold-Weather Construction: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. When the ambient temperature is within the limits indicated, use the following procedures:
 - a. 40 to 32 deg F (4 to 0 deg C): Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C).
 - b. 32 to 25 deg F (0 to -4 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry.
 - c. 25 to 20 deg F (-4 to -7 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C) if grouting. Use heat on both sides of walls under construction.
 - d. 20 deg F (-7 deg C) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C). Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F (0 deg C) within the enclosures.
 2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
 - a. 40 to 25 deg F (4 to -4 deg C): Cover masonry with a weather-resistant membrane for 48 hours after construction.

- b. 25 to 20 deg F (-4 to -7 deg C): Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h (25 km/h).
 - c. 20 deg F (-7 deg C) and Below: Provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after construction.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and above.

PART 2 - PRODUCTS

2.01 MANUFACTURERS – CONCRETE MASONRY UNITS

- A. County Materials., Eau Claire, WI
- B. Premier Block Corporation, Eau Claire, WI
- C. Anchor Block, Minnetonka, MN
- D. Trenwyth Industries, Inc.

2.02 MATERIALS – CONCRETE MASONRY UNITS

- A. Standard Concrete Masonry Units:
 - 1. Hollow Load-Bearing Concrete Masonry Units: ASTM C 90, Grade N and as follows:
 - a. Weight Classification:
 - 1) Normal weight with calcareous or siliceous gravel aggregate.
 - 2) Where required for fire resistive ratings, provide light weight masonry units with expanded slag or pumice aggregate.
 - b. Provide Type II, non-moisture-controlled units.
 - 2. Specialty Shapes: Provide special shapes where indicated and as follows:
 - a. For lintels, corners, jambs, stools, control joints, headers, bonding, and other special conditions.
 - b. Sash block shall be produced with vertical slot for use with extruded rubber control joint insert equal to H & B #RS – Standard.
 - c. Provide bullnose units for outside corners where masonry units are left exposed (building interior).

3. Size: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.

B. Ground Face Concrete Masonry Units (GFCMU)

1. “Ultra” Burnished Masonry Units as manufactured by Premier Block Corporation, Eau Claire, WI, or approved equal. All units shall conform to ASTM C90-00 moisture controlled and shall have a high density polished ground face finish.
2. All burnished ground face masonry shall receive a field applied coating of an all-acrylic waterborne sealer to provide a “wet look” gloss as recommended by the burnished masonry manufacturer.
 - a. Manufacturer: TK-Products ‘Bright Kure & Seal’ (gloss finish)
 - b. Application: Two coats, spray apply, 6 mil WFT (2 mil DFT). Application shall be conducted in the presence of block manufacturer’s representative.

C. Schedule of CMU Exposed Faces:

MARK	FACE TEXTURE	NOM.FACE SIZE (HT.x W)	COLOR*	BOND PATTERN
CMU-1	Smooth Face	8” x 16” and 4” x 16”	Standard Gray	Stacked Bond
CMU-2	Ground Face CMU w/Single Score	8” x 16”	‘Antique White’	Stacked Bond
CMU-3	Ground Face CMU w/o Score	8” x 16” and 4” x 16”	‘Antique White’	Stacked/Running Bond
CMU-4	Ground Face CMU	8” x 16”	‘Sandstone’	Running Bond
CMU-5	Spit-Face CMU	4” x 16”	‘Sienna Cream’	Running Bond

* (Colors are based on GFCMU as manufactured by Premier Block.)

- D. Integral Water Repellent:** For units at all exterior exposures, provide units produced with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer’s mortar additive according to ASTM E 514, with test period

extended to 24 hours, show no visible water or leaks on the back of the test specimen.

2.03 MORTAR AND GROUT MATERIALS: Refer to Section 04 05 13 – Masonry Mortar & Grout

2.04 REINFORCING STEEL: As follows:

- A. Steel Reinforcing Bars: Grade 60, Billet steel complying with ASTM A 615.

2.05 JOINT REINFORCEMENT

- A. General: Provide joint reinforcement formed from the following:

1. Galvanized carbon-steel wire, ASTM A 153, Class B-2, hot-dipped galvanized at interior and exterior walls.

- B. Manufacturers

1. Hohmann & Barnard, Hauppauge, NY
2. Heckman Building Products, Inc., Melrose Park, IL
3. Wire-Bond, Memphis, TN

- C. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:

1. Wire Diameter for Side Rods: 0.1483 inch (9 gage).
2. Wire Diameter for Cross Rods: 0.1483 inch (9 gage).

- D. For single-wythe masonry, provide ladder or truss configured type with single pairs of side rods. Use only ladder configured type for multi-wythe masonry walls.

- E. For multi-wythe masonry cavity wall assemblies, provide ladder design with eye hooks and adjustable rectangular pintel equal to HB Lox-All® adjustable Eye-Wire #270 or Wire-Bond Series 600 Adjustable Tab Ladder.

2.06 FACE VENEER ANCHORS

- A. Description: 1-1/2" wide, hot-dipped galvanized corrugated buck anchors with 1-1/2" long standard bend and 5/16" predrilled holes.

2.07 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME

- A. 3/4" wide x 12 ga. thick x 7 long, hot dipped galvanized 'offset strap' for field welding to steel column used in conjunction with 3/16" dia. wire, hot-dip galvanized 'vee wall tie'.
- B. Manufacturers
 - 1. Hohmann & Barnard, Hauppauge, NY: #359FH Offset Strap w/ #VWT
 - 2. Heckman Building Products, Inc., Melrose Park, IL: #315-B weld on strap anchors with #316 triangular ties.
 - 3. Wire-Bond, Memphis, TN: Type 1 weld on anchor #1000 with #1100 Series triangular ties.

2.08 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Steel bolts complying with A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter, length, and configuration indicated.
- B. Post-installed Anchors: Anchors as indicated, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.
- C. Corrosion Protection: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC 1 service condition (mild).

2.09 EMBEDDED FLASHING MATERIALS – CAVITY WALL/MULTI-WYTHE MASONRY WALLS

- A. Composite Membrane Thru-wall Flashing (See drawings for type/locations):
 - 1. Manufacturers
 - a. Carlisle Coatings & Waterproofing, Wylie, TX: 'CCW-705-TWF'
 - b. W.R. Grace & Co., Cambridge, MA: 'Perm-A-Barrier'
 - c. W.R. Meadows, Inc., Hampshire, IL: 'Air-Shield'
 - 2. Type: 40 mil, self-adhesive, cold-applied sheet consisting of 32 mils of rubberized asphalt integrally bonded to an 8 mil high-density, cross-laminated polyethylene film. Apply with manufacturer recommended mastic consisting of a rubberized, asphalt-based mastic designed to be used on all laps, seams, top edges and cuts in the flashing, and around all penetrations through the flashing.
 - 3. Surface Conditioner: Prepare all substrate surfaces behind flashing with water-based surface conditioner as recommended by flashing manufacturer.

4. Provide dam at ends, inside and outside corners of flashing per manufacturers details.
5. Termination Bar: High strength, plastic strip with pre-drilled holes spaced 6 inches apart. Profile to be trapezoidal design to provide continuous trough for caulks or mastic bead.

B. Metal Flashings

1. Provide Type 304 stainless steel drip edge flashing underneath composite flashing as indicated on the drawings. Metal drip flashing to be 3" wide with 3/8", 135 degree hemmed edge drip.

2.10 WEEP VENTS

A. Weep Vents: Provide weep vents in head joints of the first masonry unit course immediately above flashing.

1. Weep Hole Vents: Non-absorbent polymer mesh made from 100% recycled plastic available in three colors.

B. Manufacturers

Archovations, Inc. '*CavClear Weep Vents*'
Mortar Net® USA Ltd.
Sandel Construction Solutions

2.11 CAVITY WALL INSULATION

A. Where indicated on the drawings, provide rigid cavity wall insulation as follows;

1. Closed cell polyisocyanurate rigid foam core with acrylic coated aluminum foil facer per ASTM C1289, Type I, Class 1.
2. NFPA 285 tested for the exterior wall assembly specified.
3. Thickness: As shown on drawings
4. R-Value (Aged), ASTM C 1298: 6.5 per inch (min)
5. Compressive Strength (ASTM D1621): 20 psi
6. Water Absorption (ASTM C209): <0.1% by volume
7. Flame Spread (E84): <25
8. Smoke Developed (E84): >450

B. Manufacturers

1. Atlas Wall CI Board - EnergyShield® PRO
2. Hunter Panels Xci Foil

3. Firestone Building Products Enverge™ CI Foil

2.12 ACCESSORIES

A. Manufacturers

1. Hohman & Barnard, Inc. '*Mortar Net*'
2. Archovations, Inc. '*CavClear Masonry Mat*'
3. Sandel Construction Solutions

B. Mortar/Grout Screen: 1/4" square monofilament screen fabricated from high strength, non-corrosive polypropylene polymers for isolating flow of grout where indicated on the drawings. Furnish in roll form.

C. Mesh Type Mortar Stop

1. 1" high density polyethylene joint filler

D. Closed Cell Neoprene Sponge

1. 3" wide x 1/2" thick sponge strips conforming to ASTM D-1056 Grade 2A1 with adhesive backing.
2. For use at vertical expansion/control joints in masonry veneer.

2.13 SAND FILLED CORES

A. Where indicated on the drawings, fill CMU cores with clean mason's sand.

2.14 DATE STONE

A. Where indicated on the drawings, provide cut stone unit with recessed painted date numerals. Comply with recommendations of Indiana Limestone Institute of America "Indiana Limestone Handbook.

B. Cut Stone Source Options

1. Indiana Limestone, smooth finish, cut to profiles shown.
2. Winona Dolomite limestone as detailed, quarried and fabricated by Biesanz Stone Co., 4600 Goodview Road, Winona, MN 55987.
3. Anamosa Limestone, Weber Stone Co., Anamosa, IA

C. Color: Light Buff (submit sample)

2.15 MASONRY CLEANERS

- A. Manufacturers:
 - 1. Prosoco, Inc. *Sure Klean 600* Detergent
 - 2. Diedrich Technologies 222
 - 3. Chemical Products Industries, Inc.
- B. Application must receive prior approval from concrete block manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.

For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.

- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.02 PRE-INSTALLATION CONFERENCE

- A. At least two weeks before the start of above-grade masonry work, the Contractor shall schedule a pre-installation conference at the jobsite to discuss compliance with the requirements of the Contract Documents. Two weeks advance notice shall be given to the participants, who shall include the General Building Contractor, Masonry Contractor, Flashing Installer, CMU Producer and/or the manufacturer of the CMU/Mortar Integral Water-Repellent Admixture. Advise the engineer of the scheduled meeting date.

3.03 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to the opening.

- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.
- F. All penetrations (pipe, conduit, wiring, etc.) of fire rated walls shall be properly fire stopped with a U.L. listed "Through-penetration Fire Stop Assembly."

3.04 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arises, do not exceed 1/4 inch in 10 feet, nor 3/8 inch in 20 feet, nor 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet, nor 1/2 inch maximum.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For top surface of bearing walls, do not exceed 1/8 inch (3 mm) in 10 feet (3 m), nor 1/16 inch (1.5 mm) within width of a single unit.
- C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in 20 feet (12 mm in 6 m), nor 3/4 inch in 40 feet (19 mm in 12 m) or more.
- D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch (6 mm) nor plus 1/2 inch (12 mm).
- E. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch (3 mm). Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch (3 mm). Do not vary from collar-joint thickness indicated by more than minus 1/4 inch (6 mm) or plus 3/8 inch (10 mm).

3.05 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
 - 1. Match pattern indicated on drawings.
- D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.
- F. Built-in Work: As construction progresses, build-in items specified under these special provisions and other appropriate Sections of the Standard Specifications. Fill in solidly with masonry around built-in items.
- G. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
- H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- I. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- J. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above and as follows:
 - 1. Install compressible filler in joint between top of partition and underside of structure above.

3.06 INSTALLATION – MORTAR & GROUT

A. Mortar

1. Tool mortar joints when surface is thumbprint hard.
2. Keep tooling time consistent.
3. Do not strike joint too early or too late in order to maintain color consistency.
4. Cure mortar a minimum of 28 days.
5. Tool mortar joints to profile listed below when surface is thumbprint hard. Scored joints in burnished ground face CMU shall also be tooled with mortar to match head joint profile.
6. Mortar Joint Profiles
 - a. Exterior Ground Face CMU: Raked joint
 - b. Interior Ground Face CMU: Raked joint
 - c. Standard gray CMU: Concave

B. Grout

1. Install grout according to manufacturer's instructions.
 2. Work grout into masonry cores and cavities to eliminate voids.
 3. Grout hollow metal door and borrowed lite frames where installed in masonry openings.
 4. For masonry core fill grout applications, comply with the requirements of ASTM C926.
- C. Grout spaces less than 2 inches in width with fine grout. Grout spaces 2 inches or greater in width with course grout. Use low lift grouting techniques.
- D. When grouting is stopped for more than one hour, terminate grout 2 inches below top of upper masonry unit to form a positive key for subsequent grout placement.
- E. Low Lift Grouting: Place first lift of grout to a height of 16 inches and rod for grout consolidation. Place subsequent lifts in 8 inch increments and rod for grout consolidation.

3.07 HORIZONTAL JOINT REINFORCEMENT

- A. Placement of horizontal joint reinforcement with truss or ladder type joint reinforcement shall comply with par. 2109.06.3 of the 2006 International Building Code. Vertical spacing shall not exceed 16" o.c.

3.08 ADJUSTABLE VENEER TIES

- A. Bonding with adjustable wall ties shall comply with par. 2109.6.3.1.1 of the 2006 International Building Code. There shall be at least one tie for each 1.77 square feet of wall area. Neither the vertical nor horizontal spacing of the adjustable wall ties shall exceed 16 inches. The maximum vertical offset of bed joints from one wythe to the other shall be 1 1/4".

3.09 WEEPS AND VENTS

- A. Install weep holes in veneer at 24 inches on center horizontally above through wall flashing at bottom of walls.
- B. Install cavity vents at top of each cavity space, below shelf angles and at the same spacing in veneer at on center horizontally.

3.10 CAVITY BEHIND VENEER

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes.
- B. Build outer wythe to permit installation of cavity insulation and air/vapor barrier adhesive.

3.11 MASONRY FLASHINGS

- A. Extend flashings under veneer, turn up minimum (8) inches seal to sheathing over wood stud back-up.
- B. Lap end joints minimum 6 inches and seal watertight.
- C. Use flashing manufacturer's recommended adhesive and sealer.

3.12 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control and expansion joints.
- B. Form CMU control joints with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

3.13 PROTECTION

- A. Protect top of masonry walls daily.

3.14 FINAL CLEANING:

- A. After mortar is thoroughly set and cured, clean exposed masonry by first removing large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels. Wet wall surfaces with water. Clean concrete block surfaces by means of bucket and brush hand-cleaning method. If stain persists, consult Architect and brick/block manufacturer before proceeding.

END OF SECTION 04 20 00

SECTION 04 72 00 – ARCHITECTURAL CAST STONE

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Provide all labor, materials and equipment to necessary to plant cast and shape all components indicated on the drawings and indicated as ‘cast stone’.
- C. Design and furnish cast stone anchoring and wall tie components.
- D. Installing contractor shall unload, store, furnish all anchors, set, patch, clean and seal the cast stone as required.

1.2 RELATED SECTIONS

- A. Section 04 05 13 – Masonry Mortar & Grout
- B. Section 04 20 00 – Unit Masonry
- C. Section 07 90 00 – Joint Sealants

1.3 REFERENCES

- A. ACI 318 – Building Code Requirements for Reinforced Concrete
- B. ASTM A 185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
- C. ASTM A 615/A 615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Reinforced Concrete
- D. ASTM C33-Standard Specification for Concrete Aggregates
- E. ASTM C 150 – Standard Specification for Portland Cement
- F. ASTM C 173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method
- G. ASTM C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- H. ASTM C 260 – Standard Specification for Air Entrained Admixtures for Concrete

- I. ASTM C 270 – Standard Specification for Mortar for Unit Masonry
- J. ASTM C 426 – Standard Test Method for Linear Shrinkage of Concrete Masonry Units
- K. ASTM C 494/C 494M – Standard Specification for Chemical Admixtures for Concrete
- L. ASTM C 618 – Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete
- M. ASTM C 666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
- N. ASTM C 979 – Standard Specification for Coloring Pigments for Integrally Pigmented Concrete
- O. ASTM C 989 – Standard Specification for Ground Granulated Blast-furnace Slag for Use in Concrete
- P. ASTM C 1194 – Standard Test Method for Compressive Strength of Architectural Cast Stone
- Q. ASTM C 1195 – Standard Test Method for Absorption of Architectural Cast Stone
- R. ASTM C 1364 – Standard Specification for Architectural Cast Stone
- S. ASTM C 2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- T. Cast Stone Institute® Technical Manual (Current Edition)

1.4 DEFINITIONS

- A. Cast Stone – a refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
 - 1. Wet Cast Concrete Products – manufactured from measurable slump concrete.
 - a. Wet casting method: manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.5 SUBMITTAL PROCEDURES

A. Comply with Section 01 33 00 – Submittal Procedures.

1. SD-02 Shop Drawings: Submit manufacturers shop drawings including profiles, cross-sections, reinforcement, exposed faces, arrangement of joints (optional for standard or semi-custom installations), anchoring methods, wall ties, anchors, annotation of stone types and their location.
2. SD-04 Samples: Submit pieces of the Cast Stone that are representative of the general range of finish and color proposed to be furnished for the project.
3. SD-06 Test Results: submit manufacturers test results of Cast Stone previously made by manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. A current producer member of Cast Stone Institute, with a minimum of 10 years of experience in producing cast stone of types required for project.
2. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of Cast Stone required according to project schedule.
3. Manufacturer shall submit a written list of project similar in scope and at least three (3) years of age, along with owner, architect and contractor references.

B. Standards: Comply with the requirements of the Cast Stone Institute® Technical Manual and the project specifications. Where a conflict may occur, the contract documents shall prevail.

C. Mock-up: Provide full size unit(s) for use in construction of sample wall. The approved mock-up shall become the standard for appearance and workmanship for the project.

PART 2 – PRODUCTS

2.1 ARCHITECTURAL CAST STONE

A. Manufacturers

1. American Artstone Company, New Ulm, MN 56073; Phone: (800) 967-2076
2. MidCon Products, Inc., Hortonville, WI; Phone: (920) 779-4032

3. Architectural Cast Stone, Inc., Wichita, KS; Phone: (316) 262-5543
- B. Comply with ASTM C 1364
- C. Physical Properties: Provide the following:
1. Compressive Strength –_ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
 2. Absorption –_ASTM C 1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products at 28 days.
 3. Air Content-ASTM C173 or C 231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for VDT products.
 4. Freeze-Thaw-ASTM C 1364: The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
 5. Linear Shrinkage – ASTM C 426: Shrinkage shall not exceed 0.065%.
- D. Job Site Testing – One (1) sample from production units may be selected at random from the field for each 500 cubic feet delivered to the job site.
1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
 2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
 3. Field specimens shall be tested according to ASTM C 1194 and C 1195.

2.2 MATERIALS

- A. Portland cement – Type 1 or Type 111, white and/or grey, ASTM C 150.
- B. Coarse aggregates – Granite, quartz or limestone, ASTM C 33, except for gradation.
- C. Fine aggregates – Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors – Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.

E. Admixtures – Comply with the following:

1. ASTM C 260 for air-entraining admixtures.
2. ASTM C 494/C 495M Types A-G for water reducing, retarding, accelerating and high range admixtures.
3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water – Potable

G. Reinforcing bars:

1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in.
2. Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.

H. Wall Ties, Anchors and Dowels

1. The cast stone manufacturer shall be responsible for the complete design of wall ties and anchorage required for this project.
2. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, hot-dipped galvanized steel, brass, or stainless steel Type 302 or 304. Field bending of anchors/wall ties shall be provided as necessary for project conditions. Hot-dip galvanized ties damaged by field modifications shall be repaired, regalvanized or re-zinc plated to maintain complete corrosion resistant finish protection.
3. Anchors shall include split-tail, L-anchors, strap anchors, side anchors : Custom sized pre-bent and pre-punched flat plate anchors designed for connecting cast stone panels and components back to masonry backup wythe.
4. Dowel Pins: Plain-steel bars, ASTM A615, Grade 60, threaded for coil inserts cast into cast stone.

2.3 CAST STONE SHAPES

- A. Wall Cap: Custom shaped as indicated on drawings.

2.4 COLOR AND FINISH

- A. Color: Selected from manufacturer's standard range of colors.
- B. Finish: Medium Acid Etch
- C. All surfaces intend to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. and the density of such voids shall be less than 3 occurrences per any 1 in. and not obvious under direct daylight illumination at a 5 foot distance.
- D. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 foot distance.
 - 1. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
 - a. Total color difference – not greater than 6 units.
 - b. Total hue difference – not greater than 2 units.
- E. Minor chips shall not be obvious under direct daylight illumination from a 20-ft distance.
- F. Remove cement film, if required, from exposed surfaces prior to packaging for shipment.

2.5 REINFORCING

- A. Reinforce the units as required by the drawings and for safe handling and structural stress.
- B. Minimum reinforcing shall be 0.25 percent of the cross section area.
- C. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5 in. of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
- D. Panels, soffits and similar stones greater than 24 in. in one direction shall be reinforced in that direction. Units less than 24 in. in both their length and width dimension shall be non-reinforced unless otherwise specified.

2.6 CURING

- A. Cure units in a warm curing chamber approximately 100°F at 95% relative humidity for approximately 12 hours, or cure in a 95% moist environment at a minimum 70°F (21.1°C) for 16 hours after casting. Additional yard curing at 95% relative humidity shall be 350 degree-days (i.e. 7 days @ 50°F (10°C) or 5 days @ 70°F prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

2.7 MANUFACTURING TOLERANCES

- A. Cross section dimensions shall not deviate by more than $\pm 1/8$ in, whichever is greater, not to exceed $\pm 1/4$ in.
- B. Length of units shall not deviate by more than length/360 or $\pm 1/8$ in., whichever is greater, not to exceed $\pm 1/4$ in.
 - 1. Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp, bow or twist of units shall not exceed length/360 or $\pm 1/8$ in. (3 mm), whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints, and similar features – On formed sides of unit, 1/8 in., on unformed sides of units, 3/8 in. maximum deviation.

2.9 DELIVERY, STORAGE AND HANDLING

- A. Mark production units with identification marks as shown on the shop drawings.
- B. Package units and protect them from staining or damage during shipping and storage.
- C. Provide an itemized list of product to support the bill of lading.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installing contractor shall check Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

- A. Comply with Cast Stone Institute ® Technical Manual.

- B. Set stones 1/8 in. or less, within the plane of adjacent units.
- C. Joints, plus – 1/16 in., minus -1/8 in.

3.3 JOINTING

- A. Joint size:
 - 1. At stone/brick joints 3/8 in.
 - 2. At stone/stone joints in vertical position 3/8 in.
 - 3. Stone/stone joints exposed on top 3/8 in.
- B. Joint materials:
 - 1. Mortar, Type N, ASTM C 270.
 - 2. Use a full bed of mortar at all bed joints.
 - 3. Flush vertical joints full with mortar.
 - 4. Leave all joints with exposed tops or under- relieving angles open for sealant.
 - 5. Leave head joints in copings and projecting components open for sealant.
- C. Locations of joints;
 - 1. As shown on shop drawings.
 - 2. At control and expansion joints unless otherwise shown.

3.4 SETTING

- A. Drench units with clean water prior to setting.
- B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- C. Set units in full bed of mortar, unless otherwise detailed.
- D. Rake mortar joints 3/4" in. for pointing.
- E. Remove excess mortar from unit faces immediately after setting.
- F. Tuck point unit joints to a slight concave profile.

3.5 JOINT PROTECTION

- A. Comply with requirements of Section 07 90 00 – Joint Sealant.
- B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 REPAIR AND CLEANING

- A. Repair chips with touchup materials furnished by manufacturer.
- B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Consult with manufacturer for appropriate cleaners.

3.7 INSPECTION AND ACCEPTANCE

- A. Inspect finished installation according to Bulletin #36.
- B. Do not field apply water repellent until repair, cleaning, inspection and acceptance is completed.

END OF SECTION 04 72 00

END OF DIVISION 04 - MASONRY

DIVISION 05 – METALS

SECTION 05 12 00 – STRUCTURAL STEEL

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Applicable provisions of Division 1 shall govern all work under this section.
- B. Section Includes:
 - 1. Structural steel framing members
 - 2. Base plates, anchor bolts
 - 3. Grouting under base plates
 - 4. Shop primer paint and surface preparation

1.02 WORK SPECIFIED ELSEWHERE BUT PROVIDED UNDER THIS SECTION

- A. Section 04 05 00 – Masonry Mortar and Grout: Non-shrink grout

1.03 PRODUCTS FURNISHED BUT INSTALLED BY OTHERS

- A. Section 03 30 00 – Concrete: Anchors for casting into concrete.

1.04 RELATED SECTIONS

- A. Section 05 22 00 – Steel Joists
- B. Section 05 31 00 – Steel Deck
- C. Section 05 50 00 – Metal Fabrications

1.05 SUBMITTALS

- A. Submit the following with accordance Section 01 33 00 – Submittal Procedures.
 - 1. SD-02 Shop Drawings: Detail fabrication of structural steel components, include the following.
 - a. Include details of cuts, connections, splices, cambers, holes, and other pertinent data.
 - b. Provide templates for anchors and bolts for installation.
 - c. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

- d. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
 - e. Shop drawings shall be signed and sealed by a qualified professional engineer registered in the State of Wisconsin and responsible for their preparation.
- 2. SD-07 Certificates: Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
 - a. Structural steel, including chemical and physical properties.
 - b. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - c. Direct-tension indicators.
 - d. Shop primers

1.06 REFERENCED STANDARDS

- A. Referenced Specifications: Comply with recommended practices and procedures of the referenced specification standards and with the modifications as specified herein.
- B. American Society for Testing and Materials (ASTM).
 - 1. ASTM A36 – Structural Steel.
 - 2. ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. ASTM A108 – Steel Bars, Carbon, Cold-Finished, Standard Quality.
 - 4. ASTM A123 – Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
 - 5. ASTM A153 – Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 - 6. ASTM A307 – Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - 7. ASTM A325 – Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - 8. ASTM A490 – Heat-Treated Steel Structural Bolts, 150 KSI Minimum Tensile Strength.
 - 9. ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
 - 10. ASTM A501 – Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - 11. ASTM A563 – Carbon and Alloy Steel Nuts (Heavy Hex).
 - 12. ASTM A572 – High Strength Low Alloy Structural Steel.
 - 13. ASTM A992 – Steel for Structural Shapes for use in Building Framing.
 - 14. ASTM F436 – Hardened Steel Washers.
 - 15. ASTM F1554 – Steel Anchor Rods, Grades 36, 55, and 105.

- C. American Welding Society (AWS).
 - 1. AWS A2.0 – Standard Welding Symbols.
 - 2. AWS D1.1 – Structural Welding Code.
- D. American Institute of Steel Construction, Inc (AISC).
 - 1. AISC – Specification for Structural Steel Buildings, Allowable Stress Design.
 - 2. AISC – Load and Resistance Factor Design Specification for Structural Steel Buildings.
 - 3. AISC – Code of Standard Practice for Steel Buildings and Bridges.
 - 4. AISC – Specification for Architectural Exposed Structural Steel.
- E. RCSC – Research Council on Structural Connections.
 - 1. RCSC – Specification for structural joints using ASTM A325 or A490 bolts.

1.07 QUALITY ASSURANCE

- A. Standards: Comply with the applicable provisions of the Referenced Standards specified herein.
- B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certified Program and is designated an AISC Certified Plant, Category Sbd.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, Structural Welding Code, Steel.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Fabricate for delivery sequence which will expedite erection and minimize field handling. Identify pieces with suitable mark conforming to erection drawings.
- B. Protect steel against corrosion or deterioration. Store material, so as to avoid damage and distortion. Materials damaged due to mishandling shall be replaced at no additional cost to the Owner.

1.09 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Steel Shapes, Plates, Angles and Bars: As follows;
 - 1. Carbon Steel: ASTM A 36, unless otherwise shown on structural plans.
 - 2. Stainless Steel: ASTM A 572 (ASTM A 572M)
- B. Rolled Wide Flange W shapes and channel C shapes: ASTM A572, $F_y = 50$ KSI.
- C. Cold-Formed Steel Tubing: ASTM A 500, Grade B, $F_y = 46$ KSI
- D. Steel Pipe: ASTM A 53, Type E or S, Grade B, $F_y = 35$ KSI.
- E. Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490, unfinished bolts and nuts, ASTM A 307, Grade A.
- F. Welding Electrodes: AWS E70XX Electrodes.

2.02 PRIMER

- A. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.
- B. Zinc Coated: Apply G90 coating according to ASTM A 123. Apply to all structural steel exposed to weather.
- C. Shop Painting: Paint structural steel work, except members or portions of members embedded in concrete or mortar, steel shown to be fireproofed, and contact areas to be welded or riveted. Clean steel free of loose mill scale, rust, oil, and grease. Apply prime paint to provide a minimum dry film thickness of 2.0 mils.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.03 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to the greatest extent possible. Comply with AISC Code of Standard Practice for Steel Buildings and Bridges and final shop drawings. Mark and match-mark units for field assembly.

B. Bolted Connections: Install high strength bolts according to RCSC Specification for Structural Steel Joists. Connection type shall be Snug Tight except as otherwise indicated.

C. Welded Connections: Comply with AWS Code for procedures, appearance, and quality of welds.

D. Provisions for Other Work: Fabricate structural steel members to provide holes for securing other work and for passage of other work through steel framing as indicated.

2.04 SOURCE QUALITY CONTROL

A. Contractor will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Comply with testing and inspection requirements of this section specified for Field Quality Control.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements of AWS D1.1 for stud welding.

PART 3 - EXECUTION

3.01 ERECTION

A. Comply with AISC Code and Specifications and maintain work in safe and stable condition during erection. Provide temporary bracing and shoring as required, until final connections are installed. Maintain erection tolerances.

B. Set base plates on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with commercial non-shrink grout material per Section 04 05 13.

C. Splice members only where shown on final shop drawings.

3.02 FIELD CONNECTIONS

A. Bolted Connections: Install and tighten high-strength bolts according to RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts. All connections to be Snug Tight type joints unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.03 TOUCH-UP PAINTING

A. After installation, promptly clean, prepare, and prime paint or re-prime field connections, rust spots and abraded surfaces.

B. Clean and prime welds, bolt and rivet heads, abrasions of prime coat, and surfaces not previously shop primed, except surfaces to be in contact with concrete after erection.

C. Clean all surfaces of dirt, mud, oil, or grease that would impair bonding of fireproofing, concrete, or paint.

3.04 FIELD QUALITY CONTROL

A. The General Building Contractor shall hire a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

1. Test Field Bolted Connections: Checking at least 2 bolts per high strength bolted connection with a calibrated torque wrench for tension at least 5 percent higher than that shown, or as required by ASTM A325, by the method as outlined in the "Specifications for Assembly of Structural Joints Using High Strength Steel Bolts". Tension after nuts are retorqued shall be at least equal to that shown, or as required by ASTM A325.

2. Test Shop Bolted Connections: Checking at least 2 bolts of every second high strength bolted connection with a calibrated torque wrench for tension at least 5 percent higher than that shown, or as required by ASTM A325, by the method as outlined in the "Specifications for Assembly of Structural Joints Using High Strength Steel Bolts".

3. Welded Connections: Field welds will be visually inspected according to AWS D1.1. Where indicated on Drawings, perform the following tests inspection methods.

a. Liquid Penetrate Inspection: ASTM E 165.

b. Magnetic Particle Inspection: ASTM E 709, performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94.

B. Correct deficiencies in work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 05 12 00

SECTION 05 22 00 – STEEL JOISTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

B. Section Includes:

1. Open web K Series steel joists.
2. Open web LH Series steel joists.
3. Bridging and bracing.
4. Joist accessories.

1.02 RELATED SECTIONS

A. Section 05 12 00 – Structural Steel

B. Section 05 31 00 – Steel Roof Deck

C. Section 05 50 00 – Metal Fabrications

1.03 REFERENCES

A. Reference Standards: Comply with Steel Joist Institute (SJI) "Standard Specifications for Open Web Steel Joists, and Joist Girders" for types of joists indicated. Comply with American Welding Society (AWS) Structural Welding Code – Steel.

1.04 SUBMITTALS

A. SD-02 Shop Drawings: Submit complete plans, details and schedules for fabrication and erection, including layout, camber, special connections, jointing and accessories.

B. SD-07 Welders' Certificates: Submit manufacturer's certificates that welders employed on the Work have met AWS Standard Qualification Procedure within the previous 12 months.

1.05 QUALIFICATIONS

A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this project and with a record of successful in service performance. Manufacturer shall be certified by SJI to manufacture joists complying with SJI standard specifications.

B. Erector: Company specializing in performing the work of this Section with a minimum 5 years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under the provisions of SJI requirements. Store and protect products from distortion or damage.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on shop drawings.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Steel: Comply with ASTM standards as referenced in the SJI "Specifications."

B. Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490, unfinished bolts and nuts, ASTM A 307, Grade A.

C. Accessories: Provide applicable accessories, complying with SJI "Specifications", necessary to complete the installation, including but limited to bridging, bridging connectors, side wall anchors, top or bottom chord extensions and special depth bearing seats.

D. Shop Paint: Rust inhibitive paint complying with SJI "Specifications".

2.02 STEEL JOISTS

A. Manufacture steel joists according to SJI's "Specifications," with steel-angle top- and bottom-chord members, and as follows:

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Furnish special bearing seats and special extended ends.

Retain one or both subparagraphs below.

2.03 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span.
- B. Bridging: Schematically indicated. Detail and fabricate according to SJI "Specifications".
- C. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.04 FINISH

- A. Shop Painting: Paint structural steel work, except members or portions of members embedded in concrete or mortar, steel shown to be fireproofed, and contact areas to be welded or riveted. Clean steel free of loose mill scale, rust, oil, and grease. Apply prime paint to provide a minimum dry film thickness of 2.0 mils.

PART 3 - EXECUTION

3.01 ERECTION

- A. Comply with SJI "Specifications," and maintain work in safe and stable condition during erection. Do not apply construction loads until bridging and anchorages are completed.
- B. Provide sufficient temporary bracing to maintain framing safe, plumb, and true alignment until completion of erection and installation of permanent bridging and bracing.
- C. Coordinate placement of anchors on masonry construction for securing bearing plates and angles.
- D. After joist alignment and installation of framing, field weld joist seat to bearing plates.
- E. Do not field cut or alter structural members without approval of joist fabricator.
- F. After erection, prime welds, abrasions, and surfaces not shop primed.

3.02 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: ¼ inch
- B. Maximum Offset From True Alignment: ½ inch

3.03 FIELD QUALITY CONTROL

A. Testing Agency: General Building Contractor shall engage a qualified independent testing and inspection agency to perform field tests and inspections and prepare test reports. Field welds will be subject to inspection according to AWS D1.1. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

END OF SECTION 05 22 00

SECTION 05 31 00 – STEEL DECK

PART 1 – GENERAL

1.01 SECTION INCLUDES

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

B. Section Includes:

1. Steel roof deck and accessories

1.02 RELATED SECTIONS

- A. Section 05 12 00 – Structural Steel
- B. Section 05 22 00 – Steel Joists & Girders
- C. Section 05 50 00 – Metal Fabrications

1.03 REFERENCES

A. Codes and Standards:

1. American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members"
2. American Welding Society (AWS) "Structural Welding Code – Sheet Steel"
3. Steel Deck Institute (SDI) "Design Manual for Composite Decks, Form Decks and Roof Decks"

1.04 SUBMITTALS

A. SD-02 Shop Drawings: Include layout plans, deck type, deck gauge, anchorage details, and accessories.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver to site, store and protect decking on dry wood sleepers.

1.06 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on shop drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Provide steel deck as fabricated by one of the following:
 - 1. Epic Metals Corp.
 - 2. United Steel Deck, Inc.
 - 3. Vulcraft/Div. Nucor Corp.
 - 4. Wheeling Corrugating Co.

2.02 MATERIALS

- A. Steel Roof Deck: Comply with SDI requirements for type of sections, gauge, width and depth as shown on the structural drawings.
- B. Sheet Steel for Painted Units: ASTM A 611, Grade C or D.
- C. Sheet Steel for Galvanized Units: ASTM A 653, Grade A.
- D. Power Actuated Fasteners: Provide fasteners as manufactured by Hilti model X-EDN19 or X-EDNK22 nails or approved equal.
- E. Side Lap Fasteners: Provide screws as manufactured by Hilti No. 10 self tapping screws or approved equal.

2.03 ACCESSORIES

- A. Metal Accessories: Steel deck manufacture's standard accessory materials, including closure strips, roof sump pans and cant strips to match adjoining metal deck finish coating.
- B. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the decking.

2.04 FABRICATION

- A. Fabrication: Form deck units in lengths to span at least 3 supports; flush, telescoped, or nested 2-inch end laps; nested or interlocked side laps, unless otherwise indicated.
- B. Deck Units: Comply with SDI requirements for type of sections, of metal thickness, width, and depth indicated on drawings.

2.05 SHOP PRIMING

- A. Shop Painted: Roof deck units shall receive manufacturer's standard baked-on acrylic medium gray primer applied to chemically cleaned and pre-treated steel, except units exposed to weather or to be fireproofed.
- B. Zinc Coated: Galvanized coating to comply with ASTM A 653 Class G-90 coating. Apply to all metal roof deck exposed to weather or to be fireproofed.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

- A. Erect metal decking according to SDI Design Manual for Composite Decks, Form Decks, and Roof Decks.
- B. Roof Deck Panels: Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Deck panels shall be continuous over three spans with not less than 1-1/2 inch minimum bearing on steel supports.
- C. Metal Roof Deck Fasteners: Furnish and install power actuated or pneumatically driven fasteners according to deck manufacturers' instructions.
- D. Side Lap Fasteners: Secure roof deck units at side laps with metal screws installed according to manufacturer's instructions.
- E. Accessories: Place accessory units according to manufacturer's recommendations unless otherwise shown.
- F. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.

3.03 TOUCH-UP PAINTING

- A. After installation, promptly clean all surfaces of dirt, mud, oil or grease that would impair bonding of touch-up coating.
- B. Repair Painting: Wire brush and clean all rust spots and abraded areas of prime painted deck and apply repair paint.

C. Galvanized Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. Field Quality Control: All deck fasteners and side lap fasteners shall be inspected by a qualified testing agency prior to installation of insulation materials.

B. Correct any defects in fastener installation work as directed by testing agency.

END OF SECTION 05 31 00

SECTION 05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Loose bearing and leveling plates.
2. Loose steel lintels.
3. Aluminum diamond plate pit cover
4. Steel pipe bollards with thermoplastic bollard sleeve covers.
5. Safety net trolley track & rub-rail assembly
6. Bent plate O.H. sectional door jamb protectors
7. Overhead door control station
8. Removable aluminum planks (Inspection pits)
9. Movable inspection pit bridges

1.03 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-place Concrete: Placement of metal fabrications in concrete.

B. Section 04 20 00 – Unit Masonry: For installation of loose lintels and steel jambs

C. Section 05 12 00 - Structural Steel: For connection to steel framing.

- D. Section 05 52 13 – Pipe and Tube Railings
- E. Section 06 40 00 – Interior Architectural Woodwork: Countertop support brackets
- F. Section 09 90 00 - Painting
- G. Section 32 31 19 – Decorative Metal Gates

1.04 SUBMITTALS

A. Submit the following according to Section 01 33 00 – SUBMITTAL PROCEDURES:

- 1. SD-02 Shop Drawings: Showing details of fabrication, assembly and installation including templates for anchor bolt placement.
- 2. SD-04 Samples of Materials and finished products as may be requested by Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: For work exposed to view use materials selected for their smoothness and freedom from surface blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Cold-formed steel tubing : ASTM A 500, Grade B.
- D. Wide Flange Shapes: ASTM A 572 Grade 50.
- E. Steel Pipe: ASTM A 53, Type E or S, Grade B.
- F. Stainless Steel Bars and Shapes: ASTM A 276, Type 304.
- G. Stainless Steel Rods and Bolts: ASTM A 276, Type 304 or Type 316.
- H. Pit Covers: Aluminum Diamond Plate
- I. Steel Pipe Bollards: ASTM A 53, Grade B, Schedule 40, galvanized.
 - 1. Bollard Sleeves
 - a. Provide smooth vinyl post sleeves in caution yellow color of steel pipe bollard sizes indicated on the drawings.
 - b. Supplier: AbsorbentsOnLine (800) 869-9633 or equivalent.

J. Non-shrink Nonmetallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107.

K. Fasteners: Provide bolts, nuts, lag bolts, machine screws, toggle bolts, masonry anchorage devices, lock washers as required for application indicated and complying with applicable Federal standards. Hot-dip galvanize fasteners for exterior applications to comply with ASTM A 153. Provide stainless steel fasteners for exterior use where specified to comply with ASTM A 276 Type 304 or Type 316.

L. Shop Primer for Ferrous Metal: Manufacturer's or Fabricator's standard, fast curing, lead-free, universal modified alkyd primer; resistant to normal atmospheric corrosion, compatible with finish paint systems indicated, capable of providing a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements of FS TT-P-645.

M. Zinc Coated: Apply G90 coating according to ASTM A 123. Apply to all structural steel exposed to weather.

N. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.02 FABRICATION

A. General: Use materials of size and thickness shown, or, if not shown, of required size, grade and thickness to produce strength and durability in finished product. Shop-paint all items not specified to be galvanized after fabrication.

B. Weld corners and seams continuously to comply with AWS recommendations. 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 exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

1. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

C. Rough Hardware: Furnish custom-fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes for framing and supporting and anchoring woodwork.

1. Galvanize, unless otherwise indicated.

D. Loose Bearing and Leveling Plates: Provide for steel items bearing on masonry or concrete, as indicated. Drill plates to receive anchor bolts, weld anchor studs where shown, furnish unfinished.

E. Loose Steel Lintels: Fabricate from shapes and to sizes indicated. Prime paint materials after fabrication.

F. Cast-in-Place Angles: Fabricated from shapes and sizes indicated, weld anchor studs to embed face. Galvanize assembly after fabrication.

G. Miscellaneous Framing and Supports: Provide as required to complete work and not included with structural steel framework. Fabricate of welded construction in as large units as possible. Drill and tap as required to receive hardware and similar items. Include required anchors for building into other work spaced not more than 23 inches o.c.

H. Miscellaneous Steel Trim: Fabricate to shapes and sizes as required for profiles shown; continuous welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

I. Steel Pipe Railings: See Section 05 52 13 – Pipe and Tube Railings

J. Safety Net Trolley Track & Rub-Rail Assembly

1. The trolley track assembly shall consist of a shop fabricated steel angle and tube section ‘rub-rail’ running the length of the recessed inspection pits. The rubrail frame assembly shall be fabricated with embedment headed stud anchors.

2. The steel trolley tube shall be of a high quality 1-5/8” OD steel tubing with squared ends deburred for precise matching points. Standard factory finish is Blue Industrial Enamel. Stock lengths are 10’-0”; weight is 2 pounds per foot. Weld sleeves are required at each junction to connect track sections.

3. Trolley: Tube track manual trolley, 120 lb. load rating, dual rollers with connector plate predrilled at bottom.

4. The steel tube shall be shop welded to a steel ‘tee’ as indicated on the drawings. The steel tee is intended to be field welded to the vertical face of the embedded steel angle after alignment of the tube track.

a. Mock-Up Section: Prior to field welding of the steel tee to the embedded rub-rail assembly, the Contractor shall attach 10’ long sections on both sides of the inspection pit for testing and adjustments to the steel tube and trolley assembly.

5. The rub-rail assembly and steel tee brackets (connecting the trolley tube) shall be finished per par. 2.03 – Finishes below.

K Removable Aluminum Planks (Inspection pits): Where indicated on the plans of the recessed inspection pits, provide 72”L x 12”W x 2”H sections of 0.125” aluminum

5052-H32 planks. For basis of design, the removable aluminum planks are based on McNichols Co. Model M7122012 'Perf-O Grip'.

L. Movable Inspection Pit Bridges: Where indicated on the plans of the recessed inspection pits, provide shop fabricated pit 'bridges' consisting of side by side 18" wide x 2" high aluminum plank of 0.125" aluminum 5052-H32 with four (4) bent plate metal (or stock) handles. The ends of the pit bridges shall have a full width 1/4" thick aluminum plates for fitting over rub-rail assembly as shown on the drawings. For basis of design, the removable aluminum planks are based on McNichols Co. 'Perf-O Grip' Plank, Model M718201212

2.03 FINISHES

A. Shop Painting: Apply shop primer to surface of metal fabrications except those embedded in Concrete or galvanized; comply with SSPC-PA 1 and requirements indicated below:

1. Surface Preparation: Comply with SSPC-SP6" Commercial Blast Cleaning" for exterior work, and with SSPC-SP3 "Power Tool Cleaning" for interior work.
2. Strip paint edges, corners, crevices, bolts, welds and sharp edges.

B. Galvanizing: ASTM A 123 for fabricated and un-fabricated steel products made of un-coated rolled, pressed and forged steel shapes, plates, bars and strip 0.0229 inch and thicker.

C. Galvanizing Repair Paint: High zinc-dust content paint with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint-20.

D. Powder Coating (Shop Applied)

1. Where indicated on the drawings, finish fabrications with powder coating.
 - a. AAMA 2604-05 Super Durable Powder Coating
 - b. Manufacturer: Polyester based Tiger Drylac Super Durable Series 38 or approved equal.
2. Product Description: Two-coat process consisting of zinc rich primer (Tiger Drylac 69/90500) with electrostatic polyester topcoating (Tiger Drylac Series 38).
3. Finish: Smooth Matte
4. Selected by Architect from manufacturer's list of standard colors.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Perform cutting, drilling and fitting required for installation; set work accurately in location, alignment and elevation, measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.
- B. Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 1-part Portland cement to 3-parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material.
- C. Touch-up shop paint after installation. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop. Use galvanizing repair paint on damaged galvanized surfaces.

END OF SECTION 05 50 00

SECTION 05 52 13 – PIPE AND TUBE RAILINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe and tube handrails, railings, and guardrails.
- B. Related Sections include the following:
 - 1. Section 05 50 00 - Metal Fabrications
 - 2. Section 09 90 00 - Painting
 - 3. Section 32 31 19 – Decorative Metal Gates

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Handrails and Railings: Provide handrails and railings complying with requirements of ASTM E 985 and Wisconsin Administrative Code for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

A. Submit the following according to Section 01 33 00 – SUBMITTAL PROCEDURES:

1. SD-02 Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other work.
2. SD-05 Design Calculations: For fabricated items, requiring design calculations to substantial design and installation conditions, prepared, sealed, and signed by a State of Wisconsin Licensed Structural Engineer. Submit design calculations for handrails, guardrails, and railings.

1.05 PERFORMANCE REQUIREMENTS

A. Structural Performance of Handrails and Railing Systems: Provide handrails and railing systems capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved:

1. Top Rails of Guardrail Systems: Concentrated load of 200 lb applied at any point and in any direction and a uniform load of 50 lb per linear ft. applied horizontally and concurrently with uniform load of 100 lb per linear feet applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.
2. Handrails Not Serving as Top Rails: concentrated load of 200 lb applied at any point and uniform load of 50 lb per linear ft. applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.
3. In-fill Area of Guardrail Systems: Horizontal concentrated load of 200 lb applied to one sq. ft. at any point in this system, including panels, intermediate rails, balusters, or other elements composing the in-fill area. Load on infill area need not be assumed to act concurrently with load on top rails.

1.06 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

B. Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer.

1.07 STORAGE

A. Store handrails and railings in a dry, well-ventilated, weathertight place

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.09 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.10 SCHEDULING

A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that does not satisfy structural performance requirements.

PART 2 – PRODUCTS

2.01 METALS

A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

B. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:

1. Steel Tubing:
 - a. Schedule 40 hot-dipped galvanized, ASTM A135/A795.
 - b. Pipe O.D.: 1.90”
 - c. Nominal Wall Thickness: .145”
 - d. Weight per Foot: 2.84 lbs.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

3. Iron Castings: Malleable iron complying with ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

C. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.02 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners for Anchoring Handrails and Railings to Other Construction:

1. For steel handrails, railings, and fittings, use Type 304 stainless steel stud anchors equal to Hilti Kwik Bolt II. Size and embedment to be determined by railing fabricator for conditions indicated on the drawings.

2.03 FABRICATION

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form changes in direction of railing members as follows:

1. By bending.
2. By flush radius bends.
3. By any method indicated above, applicable to change in direction involved.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

G. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

H. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless Otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

I. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

J. Close exposed ends of handrail and railing members with prefabricated end fittings.

K. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch (6 mm) or less.

L. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

M. Cut, reinforce, drill, and top components as required to receive stainless steel cable system.

2.04 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.

C. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

D. For nongalvanized steel handrails and railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed handrails and railings.

1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."

F. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

2.05 STEEL FINISHES

A. PAINT

1. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoat despite prolonged exposure.

B. POWDER COATING (Shop Applied)

1. Where indicated on the drawings, finish fabrications with powder coating.
 - a. AAMA 2604-05 Super Durable Powder Coating
 - b. Manufacturer: Polyester based Tiger Drylac Super Durable Series 38 or approved equal.
2. Product Description: Two-coat process consisting of zinc rich primer (Tiger Drylac 69/90500) with electrostatic polyester topcoating (Tiger Drylac Series 38).
3. Finish: Smooth Matte
4. Selected by Architect from manufacturer's list of standard colors.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in place construction.

3.03 RAILING CONNECTIONS

A. Welded Connections: use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.04 ANCHORING POSTS

A. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.05 ANCHORING RAILING ENDS

A. Anchor posts to metal surfaces with oval flanges bolted to metal surfaces.

1. Weld flanges to railing ends.

3.06 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.07 CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

3.08 PROTECTION

A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

SECTION 05 73 16 – STAINLESS STEEL METAL RAILING SYSTEM

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Furnish and install post supported stainless steel railings, wire rope and components necessary for a complete installation.

1.02 WORK BY OTHERS

A. Section 09 90 00 – Painting: Steel posts

1.03 REFERENCE

A. American National Standards Institute (ANSI)

1. A17.1 Accessible and Usable Buildings and Facilities
2. A21.1 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
3. A58.1 Minimum Design Loads in Buildings and Other Structures.

B. American Society for Testing and Materials (ASTM)

1. A555 – Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods.
2. E 894 – Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings
3. E 935 – Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
4. E 985 – Standard Specification for Permanent Metal Railing Systems and Rails for Buildings

C. Americans with Disabilities Act Accessibility Guidelines (ADA).

D. National Association of Architectural Metal Manufacturers (NAAMM)

1. Metal Finishes Manual
2. Pipe Railing Manual
3. Stair Manual

1.04 STRUCTURAL REQUIRMENTS

A. Handrail and Guardrail assemblies and attachments shall withstand a minimum concentrated load of 200 pounds applied horizontally or vertically down at any point on the top rail. Infill area of guardrail system capable of withstanding a horizontal

concentrated load of 200 pounds applied to one square foot at any point in the system. Load not to act concurrently with loads on top rail of system in determining stress on guardrail. Handrail assemblies and guards shall be designed to resist a load of 50 pounds per linear foot (pound per foot) applied in any direction at the top and to transfer this load through the supports to the structure.

1.05 SUBMITTALS

A. Submit the following according to Section 01 33 00 – SUBMITTAL PROCEDURES:

1. SD-02 Shop Drawings: Drawings showing fabrication and installation of handrails including plans, elevations, sections, details of components, anchor details and attachment to adjoining units of work.
2. SD-03 Product Data: Manufacturer to submit approval drawings to include the following:
 - a. Section-thru details
 - b. Mounting methods
 - c. Typical Elevations
 - d. Key plan layouts

1.06 DELIVERY, STORAGE AND HANDLING

- A. Materials to be delivered to the job site in good condition and adequately protected against damage.
- B. Store on site in a location and manner to avoid damage. Stacking should be done in a manner that will prevent bending.
- C. Store material in a clean, dry location away from uncured concrete and masonry. Any protection on the railings during transportation should remain until installed.
- D. Keep handling on a site to minimum. Exercise caution to avoid damage to finishes of material.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication of products to not delay fabrication, delivery and installation.
- B. Where field measurements cannot be made without delaying the railing fabrication and delivery, obtain guaranteed dimensions in writing by the Contractor and proceed with fabrication of products to not delay fabrication, delivery and installation.

- C. Coordinate fabrication and delivery schedule of handrails with construction progress and sequence to avoid delay of railing installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Railings & Grilles. Inc.: Fort Mill, SC
- B. Q-Railing, Tustin CA
- C. AGS Stainless Inc., Bainbridge Island, WA

2.02 MATERIALS AND FINISHES

- A. All stainless steel tube and fittings to be 316 welded stainless steel.
- B. Support Posts: 2" square x .08" wall thickness stainless steel tubing cut to length from manufacturer's stock tubing.
- C. Weld Flange Base Plate: Manufacturer's sleeve type weld flange base plate pre-drilled for anchoring bolts. Shop weld to support posts. Provide stainless steel 0.06" gauge escutcheon cover, for concealment of weld flange base plate.
- D. Post Caps: Manufacturer's standard 2" x 2" slip-in post cap.
- E. End Fitting: 4" x 4" (nominal) plate flange predrilled at corners with 1.18" tube sleeve projection.

2.03 STAINLESS STEEL CABLE RAILING SYSTEM

- A. Cables
 - 1. Material: ASTM A276, Type 316 stainless steel strand.
 - 2. Diameter: 1/4"
 - 3. Finish: Mill
 - 4. Swaging: Swage hardware onto ends of cables using manufacturer's recommended methods.
- B. Cable Components
 - 1. Swaging Ferrule: Retains nonadjustable and adjustable clevis fittings onto cables.

2. Swaging Stud: Use with receiver to provide a means of tensioning cables. Use with welded receiver to connect to end post, non-tensioning end. Threaded surface treatment to prevent galling and sticking.

3. Receiver: Allows tensioning hardware to be hidden within end posts.

2.04 FINISHES

A. All machined stainless steel fittings will receive a #8 polish.

2.05 FASTENERS

A. All mechanical fasteners used shall be manufactured from stainless steel.

2.06 FABRICATION

A. All mitered and welded corners shall be ground smooth to match finish.

B. Make exposed joints butt tight and flush.

C. Interior sleeves shall be used for typical splices.

D. Fasteners are allowed at splice connection

E. Verify dimensions on site prior to shop fabrication

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate post setting drawings, diagrams, templates, instructions and directions for installation of anchorages. These include items such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete and masonry construction.

1. Coordinate delivery of anchorages to project site.
2. Coordinate that blocking is in place for all mounting fasteners

B. Clean debris and dust from surfaces and embed holes thoroughly prior to installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving proper results given the substrate and project conditions.

3.02 INSTALLATION

- A. Install according to manufacturer's drawings and direction.
- B. Fit exposed connections accurately together to form tight joints except as necessary for expansion.
- C. Perform cutting, drilling and fitting required for installation of handrails. Accurately set handrails in location, alignment, and elevation, measured from established lines and levels.
- D. Set posts plumb within a tolerance of 1/8 inch (3 mm).
- E. When fastening to in-place construction, provide anchorage devices and fittings to properly secure rail to in-place construction. Examples of such devices include threaded fittings (for concrete inserts), toggle bolts and through-bolts. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

3.03 PROTECTION

- A. Upon delivery railing may have protective wrapping. At completion of railing installation, immediately remove any protective wrapping and clean all work for inspection and approval.
- B. After installation, General Contractor or Owner shall be responsible for protection of railings during the balance of construction.
- C. When cleaning stainless steel surfaces use plain water containing a mild soap or detergent. No abrasive agents or harsh chemicals shall be used.

END OF SECTION 05 73 16

END OF DIVISION 05 - METALS

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Applicable provisions of Division 1 shall govern the work under this section. This work under this section includes the furnishing and installation of all rough carpentry items.

B. Work includes:

1. Treated wood blocking (where indicated)
2. Laminated Strand Lumber (LSL) subfascia
3. Wood blocking, furring
4. Fasteners, anchors

1.02 RELATED SECTIONS

A. Section 06 20 00 – Finish Carpentry

B. Section 06 40 00 – Interior Architectural Woodwork

1.03 SUBMITTALS

A. SD-03 Product Data: Engineered wood products, sheathing, framing connectors, and construction adhesives.

PART 2 - PRODUCTS

2.01 FRAMING MATERIALS

A. Lumber, General: Furnish grade stamped lumber that is dressed S4S and complies with PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.

1. Provide seasoned lumber with 19 percent moisture content at time of dressing and shipment, for sizes 2 inches or less in thickness.

B. Lumber for Miscellaneous Uses: Unless otherwise indicated, provide "Standard" grade light-framing-size lumber of any species for support of other construction, including rooftop equipment and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members.

1. Provide all miscellaneous wood blocking not indicated as provided by other trades/Sections.

C. Preservative pressure treat lumber and plywood with water-borne preservatives to comply with AWPB C2 and C9, respectively, and with requirements indicated below. Mark each treated item with the AWPB or SPIB Quality Mark Requirements.

1. Pressure-treat above ground items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:

- a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
- b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
- c. Wood framing members less than 18 inches above grade.
- d. Wood floor plates installed over concrete slabs directly in contact with earth.

1. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPB M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.02 LAMINATED STRAND LUMBER

A. Engineered laminated strand, 1,300,000 psi modulus of elasticity

B. Manufacturers

1. Weyerhaeuser
2. Louisiana Pacific
3. Vandermeer Forest Products

2.03 FASTENERS

A. Rough Framing: Provide fasteners of size and type indicated on the drawings or as recommended by manufacturers that comply with the following requirements. Where rough carpentry is exposed to weather, in ground contact, or in areas of high relative humidity, provide hot-double dipped zinc-coated fasteners per ASTM A 153 or AISI Type 304 stainless steel fasteners.

1. Nails, Wire, Brads, and Staples: FS FF-N-105.
2. Power Driven Fasteners: National Evaluation Report NER-272.
3. Wood Screws: ANSI B18.6.1.
4. Lag Bolts: ANSI B18.2.1.

5. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install rough carpentry work to comply with N.F.P.A. "Manual of House Framing, Form E30," "APA Design/Construction Guide - Residential & Commercial," and the following:
 1. Recommendations of engineered wood products manufacturer.
 2. Recommendations of manufacturer of sheathing, underlayment and other products not covered in above publications.
- B. Set rough carpentry to required levels and lines, with members plumb and true and cut to fit.
- C. Securely attach carpentry work to substrates and supporting members using fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
- D. Install fasteners without splitting wood; fasten panel products to allow for expansion at joints unless otherwise indicated.

END OF SECTION 06 10 00

SECTION 06 20 00 – FINISH CARPENTRY

PART 1 – GENERAL

SECTION INTENDED TO SPECIFY EXPOSED CARPENTRY WORK NOT INCLUDED IN SECTIONS FOR ROUGH CARPENTRY AND ARCHITECTURAL WOODWORK.

1.01 WORK INCLUDED

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Work includes:
 - 1. Hardware and attachment accessories
 - 2. Installation of architectural woodwork
 - 3. Door assembly installation
 - 4. Toilet room accessories installation

1.02 RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry
- B. Section 06 40 00 – Interior Architectural Woodwork
- C. Section 08 11 13 – Steel Doors & Frames
- D. Section 08 71 00 – Finish Hardware
- E. Section 10 28 00 – Toilet and Bath Accessories

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Softwood Lumber: Comply with PS 20 and applicable grading rules of respective grading and inspecting agency for species and product indicated. Manufacture to sizes and patterns using seasoned lumber. Use pieces made from solid lumber for transparent finished work, and glued-up or solid, at contractor's option for painted work.
- B. Fasteners and Anchorages: Provide nails, screws and other anchoring devices of type, size, material and finish suitable for intended use and required to provide secure attachment, concealed where possible. All fasteners shall be hot-dip galvanized fasteners to comply with ASTM A 153.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install finish carpentry work plumb, level, true and straight with no distortions. Shim as required using concealed shims, scribe and cut finish carpentry items to fit adjoining work. Anchor finish carpentry work securely to supports and substrates, using concealed fasteners and blind nailing where possible. Use fine finishing nails for exposed nailing except as indicated, countersunk and filled flush with finished surface.

1. Door Assemblies: Refer to Section 08 11 13.
2. Hardware Installation: Refer to Section 08 71 00.
3. Toilet Room Accessories Installation: Refer to Section 10 28 00.

END OF SECTION 06 20 00

SECTION 06 40 00 – INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Work includes:
 - 1. Plastic laminate cabinets, countertops, shelves, coat hooks, cabinet hardware.
 - 2. Countertop support brackets
 - 3. Solid surface fabrications (countertops, vanity tops, sink bowls, window stools).

1.02 RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry
- B. Section 06 20 00 – Finished Carpentry

1.03 REFERENCES

- A. ANSI / BHMA A156.9 – Cabinet Hardware
- B. AWI – Quality Standards

1.04 SUBMITTALS

- A. SD-02 Shop Drawings: Submit shop drawings for each item of architectural woodwork.
- B. SD-04 Samples: Submit finished samples of each plastic laminate; and of each type of cabinet hardware.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacturing the products specified in this section with a minimum of five (5) years of experience.

1.06 FIELD MEASUREMENTS

- A. The cabinet manufacturer shall be responsible for confirming all field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 PLASTIC LAMINATE MATERIALS

A. Manufacturers

1. The color selections listed in the Color Schedule is based on plastic laminates manufactured by Formica. The following manufacturer's will be accepted subject to approval by the Architect.

- a. Wilsonart
- b. Nevamar
- c. Pionite

B. Sheet Materials

1. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:

- a. Particleboard: NPA 8.
- b. Medium-Density Fiberboard: NPA 9.
- c. Hardwood Plywood: HPMA FE.

2. All particle board and fiberboard core material shall be moisture-resistant M-3 Core.

C. Laminated Plastics/Finishes:

1. High-pressure plastic laminate, .030" in thickness, for exterior cabinet surfaces shall exceed NEMA LD3-1991 GP28 standards including thickness.

a. All exposed vertical panels to be laminated using a natural setting hybrid P.V.A. Type III water resistant adhesive that cures through a cold chemical process under pressure. Methods requiring heat or contact methods are not allowed.

b. Exterior Color Selection Available:

- 1) Standard finish vertical surface laminate from standard stock colors consisting of wood grain patterns and solid colors.
- 2) Direction of wood grain to be vertical on door, end panels, fascia panels, and exposed backs; horizontal on drawer faces, aprons, and top rails.

c. Plastic Laminate Balancing Sheet: High-pressure cabinet liner, .020" in thickness shall meet NEMA LD3-1991 CL 20 standards. Use for balancing exterior surface laminates. Use at all sink cabinet interior surfaces and concealed exterior surfaces. Color: Selected by Architect from manufacturer's standard range of colors.

- d. Countertop High Pressure Plastic Laminate:
 - 1) High-pressure plastic laminate, textured finish .050" thickness or .042" post-forming grade as detailed.
 - 2) Heavy gauge neutral colored backing sheet for balanced construction.
 - e. Melamine Laminate:
 - 1) Melamine resin impregnated, 80 gram PSM minimum, surface laminated to core under pressure.
 - 2) Shall meet NEMA LD3.3-1991 GP28 standards and NEMA LD3-1991 CL20 standards.
 - 3) Pressure fused laminate for cabinet interiors behind doors and drawers. Color: White, Light Beige. Interior of open cabinets to be high-pressure laminate. Underside of wall cabinets to be high-pressure laminate.
 - 4) Shall be balanced at all concealed surfaces with phenolic backer. Unsurfaced coreboard not allowed.
2. Particleboard Core:
- a. Particleboard to be 45 lb. density, of balanced 3-ply construction with moisture content not to exceed 8%. Particleboard shall conform to ANSI A208.1-1993, type M-3. Shall meet the following minimum standards:
 - 1) Face screw-holding power-370 lbs.
 - 2) Edge screw-holding power-315 lbs.
 - b. Particleboard cabinet components to be of the following minimum core thicknesses prior to lamination:
 - 1) 3/8": cabinet backs.
 - 2) 1/2": dividers, as detailed.
 - 3) 3/4": base and tall cabinet tops and bottoms, cabinet sides, drawer spreaders, door/drawer, cabinet back rear hang-strips, dividers as detailed, expose cabinet backs.
 - 4) 1": wall cabinet tops and bottoms, all shelving in cabinets.
3. Fiberboard Core:
- a. Uniform, medium density conforming to ANSI A208.2. Shall meet the following minimum standards:
 - 1) Screw holding, face: 355 lbs.
 - 2) Screw holding, edge: 300 lbs.
 - 3) Modulus of rupture: 4,500 psi.
 - 4) Modulus of elasticity: 500,000 psi.
 - 5) Internal bond: 100 psi.

- b. Fiberboard components to be of the following minimum core thicknesses prior to lamination:
 - 1) 1/4": drawer bottom.
 - 2) 1/2": drawer sides, sub-front and back. Drawer under bottom stiffeners.
 - 3) 3/4": framed glass door.
 - 4. Plywood Core:
 - a. Plywood to be 3/4", exterior grade, of the ply and grade as follows:
 - 1) 7 ply Fir, A/B grade: sink cabinet body, door, sink apron.
 - 2) 5 ply, pressure treated to .40 retention, C/C plug and touch sanded: sub-base platform at base and tall cabinets.
 - 5. Edging types. Provide one or more of the following according to Paragraph 2.01.C, 6., "Edging Locations":
 - a. PVC, .020". Solid, high impact, purified, color-thru, acid resistant PVC edging.
 - b. 3mm thick PVC. Solid, high impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives. A "full line" of solid colors, patterns and woodgrains for exterior high-pressure decorative laminate color selections shall be available (Wilsonart "Color Quest", Formica "Color Portfolio", or equals by Pionite & Nevamar, or approved equal).
 - 6. Edging Locations. Provide the above-specified edging types at the following locations, of the following colors:
 - a. Door/Drawer-Front Edging: 3mm PVC
 - b. Cabinet body edge, including door/drawer front spacer rail: .020" PVC, color matched to door/drawer face.
 - c. Interior body component edging, interior dividers, drawer body, shelf: .020" PVC to match cabinet interior surface color.

2.02 CABINET HARDWARE

A. Hinges:

- 1. Concealed heavy-duty European style self-closing hinge. Fully adjustable for Clockwise counterclockwise, toe in and out door alignment with 170 degree swing. Provide base plates to maintain 1/8" (32 mm) reveals between doors/drawers within the same cabinet and between doors/drawers on adjoining cabinets. Provide lifetime materials warranty/guarantee by hinge manufacturer.
- 2. One pair per door to 48" height. One and one-half pair over 48" in height. Hinge to accommodate 13/16" thick laminated door and allow 170-degree swing.

B. Pulls:

1. Manufacturers
 - a. Amerock
 - b. Hafele
 - c. Stanley
2. 4" Wire design
3. Provide two at drawers over 29".
4. Finish to be available in Chrome Powder Finish, Black, Beige, Dove Gray, or White epoxy coated.

C. Drawer Slides:

1. Standard Drawers: To be of self-closing design, epoxy powder coated to match drawer body color, with positive in-stop, out-stop, and out-keeper to maintain drawer in 80% open position. Captive nylon rollers, front and rear. Minimum 100 lb. dynamic load rating at 50,000 cycles. Fulterer #FR2021, or K&V #1286.

D. Catches

1. Provide one top-mounted magnetic catch for base and wall cabinet door. Provide two at each tall cabinet door. Catch housing to be molded in White. EPCO #1000, or approved equal.
2. Roller catch for mobile cabinets. J.G. Edelen #248, or approved equal.

E. Adjustable Shelf Supports: To be twin pin design with antitip-up shelf restraints for both 3/4" and 1" shelves. Load rating to be minimum 300 lbs. each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection.

F. Locks: Hinged doors and drawers to be provided with disc tumbler lock keyed alike and master keyed. Dull chrome finish.

1. Manufacturers
 - a. National Cabinet Lock, Atlanta, GA., #M4-7054.
 - b. Timberline
 - c. Best

2.03 COUNTERTOP SUPPORT BRACKETS

A. Countertop support brackets shall be shop fabricated from 1/4" thick x 2-1/2" wide flat stock steel bent to profiles indicated on the drawings with diagonal brace. Pre-drill holes for anchor bolts and countertop fasteners.

B. Finish: Shop applied powder coat finish as specified under Section 05 50 00 – Metal fabrications. Color to be selected by Architect.

2.04 SOLID SURFACE FABRICATIONS

A. Manufacturers

1. Meganite™ Acrylic Solid Surface
2. Avonite
3. Corian

C. Colors: Refer to Color Schedule.

D. Vanity Tops: Fabricate to width indicated on plan. Vanity countertops shall be 25” deep with 6” high dropped front apron and 4” high backsplash (include backsplash returns at end walls). Include all countertop substrates, countertop support brackets, wall cleats and related accessories necessary for a complete installation.

1. Vanity Sink Bowls: Provide solid surface manufacturer’s standard oval shaped integral bowl.
 - a. Basis of Design: Meganite™ Model 1613-VO LAV
 - b. Color: Selected from manufacturer’s standard range of colors.
 - c. Inside Dimensions: 16.3” x 13” x 5.3” deep

E. Window Stools: Fabricate from ½” thick solid surface to stool depth indicated on the plan with a 1-1/4” dropped edge and 1 inch “ear” extensions at window jamb openings.’

2.05 SHELF STANDARDS

A. Heavy-duty 12-gauge steel, 7/8” wide with anochrome finish equal to Knape & Vogt #187 Series. Provide shelf brackets of matching KV #187 series with anochrome finish. Refer to drawings for bracket depths.

2.06 COAT RACK SHELIVING

A. 1-1/16” O.D. stainless steel heavy-duty tubing equal to Knape & Vogt 660 Series with end caps and wall mounted support brackets. Shelving to be 1” thick x 12” deep plastic laminate finished particle board cores with 3 mm PVC edging.

2.07 FABRICATION

A. Components:

1. Sub-Base:
 - a. Cabinet Sub-base: To be separate and continuous (no cabinet body sides-to-floor), with concealed fastening to cabinet bottom. Ladder-type construction, of front, back, and intermediates.
2. Base to be recessed 3/4" at finished end conditions for (Division 9) vinyl base.
3. Cabinet Top and Bottom:
 - a. Solid sub-top to be furnished for all base and tall cabinets. Sub-top to be 3/4" thick.
 - b. Wall cabinet and library stack bottoms and tops to be 1" thick.
 - c. Exterior exposed wall cabinet bottoms to be high pressure laminate, both sides. Assembly devices to be concealed on bottom side of wall cabinets.
4. Cabinet Ends:
 - a. Holes drilled for adjustable shelves 1-1/4" on center.
 - b. Exposed exterior cabinet ends to be laminated with high-pressure plastic laminate, balanced with high-pressure cabinet liner interior surface.
5. Fixed and Adjustable Shelves:
 - a. Shelf Thickness Behind doors: 1" thick up to 27" wide, 1" thick 28" wide and over.
 - b. Shelf Thickness at Open Cabinets: 1" thick for all widths.
6. Cabinet Backs:
 - a. Cabinet back to be fully housed into sides, top, and bottom. Rear, unexposed, side of back to receive continuous bead of hot melt adhesive at joints. Back shall be a minimum 3/8" thick and fully inset in rear of body. Back to be recessed 7/8" from cabinet rear.
 - b. Hang rails shall be 3-3/4" high, glued to rear of cabinet back and mechanically fastened to cabinet sides. Provide minimum of 2 at base, 2 at wall, and 3 at tall cabinets.
7. Door and Drawer Fronts:
 - a. Laminated door and drawer fronts to be 13/16" thick for all hinged and sliding doors. Drawer fronts and hinged doors are to overlay the cabinet body and fitted with silencer bumpers. Maintain a maximum 1/8" reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
 - b. Stile and Rail doors to be 13/16" thick with full 1/4" plate glass (hinged or sliding). All exposed lite-opening edges to be trimmed and glazed with extruded vinyl glazing bead.

8. Drawers:
 - a. Drawer fronts shall be applied to separate drawer body component sub-front.
 - b. Drawer sides shall be dadoed and glued to receive front and back.
 - c. Drawer bottom to be housed into front, sides, and back. Underside of drawer to receive continuous bead of hot melt adhesive at joints. Reinforce drawer bottoms with 1/2 " x 4" front-to-back intermediate underbody stiffeners, hot melt glued and fastened. One at 24", two at 36", four at 48".
 - d. Paper storage drawers fitted with full width hood at back.
 - e. All drawers shall have roller guides as specified herein.
 - f. All exposed edges shall be 3mm PVC in a color selected from manufacturer's standard.
 - g. Vertical and Horizontal Dividers: One of the following as indicated by cabinet number:
 - h. Natural hardboard 1/4" thick, smooth both faces. Secured in cabinet with molded plastic clips.
 - i. Pressure Fused laminate 3/4" thickness. Secured in cabinet with molded plastic clips or dowels.
 - j. Door/Drawer Front Rail: Provide minimum 3/4" x 6" x full width cabinet body rails immediately behind all door/drawer and multiple drawer horizontal joints.

B. Plastic Laminate Countertops

1. High-pressure plastic laminate bonded to particleboard core. Thickness as shown on plans. Underside to be properly balanced with heavy gauge backing sheet. Furnish countertops with edge treatment and design profile as shown on drawings. Provide tops in as long as practical continuous lengths.
2. Provide field glued splines at joints. No joints closer than 24" either side of sink cutout.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

- A. Set and secure casework in place; rigid, plumb, and level.
- B. Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.
- C. Tops: Anchor securely to base units/brackets/wall.

END OF SECTION 06 40 00

END OF DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 13 53 – ELASTOMERIC SHEET WATERPROOFING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section Includes:
 - 1. The work includes installation of a waterproof membrane system to the concrete foundation walls where the finished grade extends above the interior finished floor level, and underslab at the recessed inspection pits.
 - 2. Surface preparation.
 - 3. Application of rolled, self-adhering waterproofing membrane system.
 - 4. Rigid insulation protection board.

1.02 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 07 21 13 – Board Insulation: Protection board

1.03 REFERENCES

- A. ASTM D 146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.
- B. ASTM D 412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- C. ASTM D 570-98 - Standard Test Method for Water Absorption of Plastics.
- D. ASTM E 96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.
- E. ASTM E 154-99 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.04 SUBMITTALS

- A. Submit the following according to Section 01 33 00 – Submittal Procedures.
1. SD-03 Product Data: Submit manufacturer's product data.
 2. SD SD-08 Manufacturer's Instructions: Application instructions.
 3. SD SD-09 Manufacturer's Field Reports: Submit field report of manufacturer's representative at the jobsite following installation.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.
- B. Installer: A firm which has at least 3 years experience in work of the type required by this section.
- C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.
- D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.
- E. Schedule Coordination: Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean dry area according to manufacturer's instructions.
- C. Store adhesives and primers at temperatures of 40°F (5°C) and above to facilitate handling.
- D. Store membrane cartons on pallets.
- E. Do not store at temperatures above 90°F (32°C) for extended periods.

- F. Keep away from sparks and flames.
- G. Completely cover when stored outside. Protect from rain.
- H. Protect materials during handling and application to prevent damage or contamination.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Product not intended for uses subject to abuse or permanent exposure to the elements.
- B. Protect rolls from direct sunlight until ready for use.
- C. Do not apply membrane when air or surface temperatures are below 40°F (4°C).
- D. Do not apply to frozen concrete.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Foundation Wall Membrane
 - 1. Carlisle Coatings & Waterproofing; MiraDRI 860/861
 - 2. Grace Construction Products; Bituthene 3000
 - 3. W. R. Meadows, Inc., Hampshire, IL: Mel-Rol
- B. Underslab Membrane
 - 1. Grace 300 Preprufe
 - 2. CETCO® 'Coreflex 60'

2.02 MATERIALS – FOUNDATION WALLS

- A. Rolled, Self-Adhering Waterproofing Membrane: Polymeric waterproofing membrane protected by release paper on cross-laminated polyethylene carrier film with exposed polymeric membrane strips on both sides protected by pull-off release strips.
 - 1. Performance Based Specification: Waterproofing membrane shall have the following characteristics:
 - a. Thickness:
 - 1) Carrier Film: 4 mils.
 - 2) Polymeric Membrane: 56 mils.
 - b. Tensile Strength, ASTM D 412, Die C:
 - 1) Carrier Film: 5,900 psi (40.71 MPa) minimum.
 - c. Elongation, ASTM D 412, Die C: Polymeric Membrane: 455 percent minimum.

- d. Peel Adhesion:
 - 1) Dry: 7 to 11 pounds/inch (125 to 196 g/mm) width, minimum.
 - 2) Wet: 7 to 12 pounds/inch (125 to 214 g/mm) width, minimum.
- e. Pliability, ASTM D 146:
 - 1) 180 Degree Bend: Unaffected.
 - 2) 1 Inch (25.4 mm) Mandrel at -25°F (-32°C): Unaffected.
- f. Water Vapor Permeance, ASTM E 96, Method B: 5.72×10^{-9} g/Pa-s-m².
- g. Water Absorption, ASTM D 570: 0.1 percent, 72 hours maximum.
- h. Resistance to Hydrostatic Head: Equivalent to 240 feet of water.
- i. Puncture Resistance, ASTM E 154: 67 pounds.
- j. Exposure to Fungi, Soil Test: Pass, 16 weeks.
- k. Color:
 - 1) Carrier Film: White.
 - 2) Polymeric Membrane: Black.

2.03 MATERIALS – UNDERSLAB WATERPROOFING MEMBRANE

A. Pre-applied Integrally Bonded Sheet Waterproofing Membrane: 1.2mm (0.046 in) nominal thickness composite sheet membrane comprising 0.8 mm (0.030 in.) of high density polyethylene film, and layers of specially formulated synthetic adhesive layers. The membrane shall form an integral and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete. Provide membrane with the following physical properties:

- 1. Thickness: ASTM D3767, 0.046 in.
- 2. Lateral Water Migration Resistance: ASTM D5385, modified. Pass at 231ft. of hydrostatic head pressure.
- 3. Low Temperature Flexibility: ASTM D1970. Unaffected at -20 deg. F.
- 4. Elongation: 500 %, ASTM D412, modified.
- 5. Tensile Strength: ASTM D412; 4,000 psi
- 6. Puncture Resistance: 221 lbs.; ASTM E154
- 7. Permeance to water vapor transmission: 0.01 perms; ASTM E96, method

2.04 ACCESSORIES

A. Primer:

- 1. Temperatures Above 40°F (4°C): Manufacturer's recommended water base primer
- 2. Temperatures Above 20°F (-7°C): Manufacturer's recommended VOC Compliant Solvent Base Primer or Standard Solvent Base Primer.

B. Flashing and Fillets: Manufacturer's standard liquid membrane.

- C. Pointing Mastic
- D. Corner Tape: Detail Strip.
- E. Waterproofing Protection Course: Refer to Section 07 21 13–Board Insulation

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing according to manufacturer's instructions.
- C. Do not apply waterproofing to surfaces unacceptable to manufacturer.
- d. Concrete surfaces must be clean, smooth and free of standing water.
- E. Patch all holes and voids and smooth out any surface misalignments.

3.03 APPLICATION - VERTICAL SURFACES

- A. Apply waterproofing membrane system according to manufacturer's instructions.
- B. Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.
- C. Prime surfaces to be covered in one working day with applicable primer. Re-prime uncovered surfaces next day.
- D. Prior to covering membrane and backfilling, allow and schedule inspection of membrane by membrane manufacturer's representative in presence of Architect and installation contractor. Complete all corrective action as recommended by membrane manufacturer's representative. Seal edges of patches with pointing mastic.
- E. Perform flood testing of horizontal applications, as required. Mark leaks and repair when membrane dries.

F. Avoid use of products that contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

3.04 APPLICATION – HORIZONTAL UNDERSLAB SURFACES

A. Strictly comply with installation instructions in manufacturer's published literature, including but not limited to, the following:

1. Place the membrane HDPE film side to the substrate with the clear plastic release liner facing towards the concrete pour. End laps should be staggered to avoid a build-up of layers.
2. Leave the plastic release liner in position until overlap procedure is completed.
3. Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap.
4. Peel back the plastic release liner from between the overlaps as the two layers are bonded together. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller.
5. Completely remove the plastic liner to expose the protective coating. Any initial tack will quickly disappear.

3.05 PROTECTION BOARD INSTALLATION

- A. Prepare and clean waterproof membrane surface.
- B. Apply rigid insulation boards with long edge horizontally.
- C. Secure boards to foundation wall with adhesive prior to backfilling operations. Butt all edges tightly.
- D. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION 07 13 53

SECTION 07 21 13 – BOARD INSULATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section Includes:
 - 1. Furnish all labor, materials, and equipment necessary for the installation of board insulation where indicated on the drawings.
 - 2. Underslab insulation at interior floors.
 - 3. Perimeter insulation at foundation walls.
 - 4. Protection board applied over elastomeric sheet waterproofing.

1.02 RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete
- B. Section 04 20 00 – Unit Masonry : Cavity wall insulation
- C. Section 07 13 53 – Elastomeric Sheet Waterproofing: Protection board

1.03 REFERENCES

- A. ASTM C578-92, standard specification for rigid, cellular polystyrene thermal insulation.

1.04 SUBMITTALS

- A. Submit the following according to Section 01 33 00 – Submittal Procedures.
 - 1. SD-03 Manufacturer's product data.

PART 2 - MATERIALS

2.01 MANUFACTURERS

- A. Dow 'Styrofoam'
- B. Owens Corning 'Foamular®'
- C. Diversifoam Products 'Certifoam'

2.02 MATERIALS

A. Extruded Polystyrene Insulation

1. Board Size: 48" x 96" x thicknesses indicated on drawings.
2. Thermal Resistance: R-5.4 @ 40° F, 5.0 @ 75° F per inch of thickness.
3. Minimum Compressive Strength: ASTM D1621
 - a. Vertical Surface Perimeter Insulation: 25 psi
 - b. Vertical Surface Protection Board: 25 psi
 - c. Horizontal Surface Protection Board: 25 psi
 - d. Underslab Insulation @ Operations Building: 25 psi
 - e. Underslab Insulation @ Inspection Building: 40 psi

B. Adhesive

1. Adhere insulation to concrete foundation walls adhesive as recommended by board manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Underslab Base: Fine grade aggregate base to provide for a level and consistent base without voids, humps or depressions. Re-compact areas disturbed by grading operations.

B. Perimeter Insulation: Examine foundation wall surfaces to perimeter insulation. Notify Architect if surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

1. If not indicated, extend insulation a minimum of 48 inches below exterior grade line.

3.02 INSTALLATION

A. Underslab Insulation

1. Butt end joints and edges tight to adjacent board.

B. Foundation Walls – Perimeter Insulation

1. Apply adhesive to adhere board insulation to face of foundation walls.
2. Butt end joints and edges tight to adjacent board with long edges horizontal.

3.03 CLEAN-UP: Remove all scraps and insulation debris from jobsite.

END OF SECTION 07 21 13

SECTION 07 21 16 – BATT INSULATION

PART 1 – GENERAL

1.01 WORK INCLUDED

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

B. Work includes:

1. Fiberglass batt wall insulation.
2. Vapor retarder membrane barrier

1.02 RELATED SECTIONS

A. Section 09 22 16 – Metal Studs

1.03 REFERENCES

A. ASTM C665 – Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

B. FS HH-I-521 – Insulation Blankets, Thermal

1.04 PERFORMANCE

A. Thermal resistivity or “R-value” represents the reciprocal of thermal conductivity (k-value), which is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one sq. ft. per hour at mean temperatures indicated.

B. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per ASTM E 119, ASTM E 84, and ASTM E 136, as applicable, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1.05 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-03 Product Information: Submit manufacturer’s product data for each form and type of insulation indicated.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Batt Insulation

1. Johns Manville
2. Knauf
3. Owens Corning
4. CertainTeed

B. Reinforced-Polyethylene Vapor Retarders

1. Ravin Industries, Inc., Sioux Falls, SD; DURA-SKRIM 6WW
2. Reef Industries, Inc., Houston, TX: Griffolyn® Type-65

2.02 MATERIALS

A. Insulation

1. Friction Fit Mineral Fiber Blanket/Batt Insulation: ASTM C 665 for Type I, and as follows:
 - a. Mineral Fiber Type: Fibers manufactured from glass, formaldehyde-free.
 - b. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50.
2. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation or mechanical anchors securely to substrates indicated without damaging or corroding either insulation, anchors, or substrates.

B. Vapor Retarder Membranes

1. Reinforced-Polyethylene Vapor Retarder: 3-ply laminated 6 mils (0.15 mm) thick high-strength polyethylene film with reinforced scrim with a maximum permeance rating of 0.07 perms.
2. Vapor-Retarder Tape: Pressure sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation. Report any signs of potential air infiltration through exterior wall sheathing to the General Building Contractor prior to proceeding with installation of batt insulation.

3.02 INSTALLATION

A. Insulation

1. Install insulation according to manufacturer's instructions.
2. Trim insulation neatly to fit spaces.
3. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

B. Vapor-Retarder Membrane Barrier

1. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure and seal in place with tape as recommended by manufacturer. Extend vapor retarder to cover miscellaneous voids in insulated substrates.
2. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Seal vapor retarders at perimeters, wall openings and at lap joints.
3. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder tape. Locate all joints over framing members or other solid substrates.
4. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with tape to create an airtight seal.
5. Repair any tears or punctures in vapor retarders immediately before concealment by other work.

END OF SECTION 07 21 16

SECTION 07 21 19 – FOAMED-IN-PLACE INSULATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

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

B. Work includes;

1. Foamed-in-place masonry insulation

1.02 RELATED SECTIONS

A. Section 04 20 00 – Unit Masonry

B. Section 07 27 26 – Fluid Applied Membrane Air Barrier: Spray-applied polyurethane foam (air barrier application).

1.03 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-03 Product Data

2. SD-06 Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance characteristics and sound abatement characteristics.

3. SD-08 Material Safety Data Sheet: Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CFR 1910 1200.

1.04 QUALITY ASSURANCE

A. Manufacturing Standards: Provide Insulation produced by a single and approved manufacturer.

B. Installer qualifications for Foamed-in-place Masonry Insulation: Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and which has not less than three years direct experience in the installation of the product used.

C. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, having been determined by testing, per methods indicated below, by a testing agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: ASTM E-119
2. Surface Burning Characteristics: ASTM E-84
3. Combustion Characteristics: ASTM E-136

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Foamed-in-place masonry insulation

1. Tailored Chemical Products, Hickory, N.C.: "Core-Fill 500".
2. Thermco™, Thermal Corporation of America, Mt. Pleasant, IA
3. CoreFoam, Inc., Knoxville, TN

2.02 INSULATING MATERIALS

A. Foamed-in-Place Masonry Insulation: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly rationed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.

1. Fire-Resistance Ratings; Minimum four (4) hour fire resistance wall rating (ASTM E-119) for 8" and 12" concrete masonry units when used in standard two (2) hour rated CMUs.
2. Surface Burning Characteristics; Maximum flame spread, smoke developed and fuel contributed of 15, 75 and 0 respectively.
3. Combustion Characteristics; Must be noncombustible, Class A building material.
4. Thermal Values; "R" Value of 4.9/inch @ 32 degrees F mean; ASTM C-177. "R" values for block as follows: 8" CMU – 14.2, 12" CMU – 20.0 (values based on 80 lb. density block).
5. Sound Abatement; Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8" wall assembly (ASTM E 90-90).

PART 3 – EXECUTION

3.01 PREPARATION

- A. Verify that work by other trades to be embedded in CMU walls has been completed and ready to be encapsulated with foam.
- B. Coordinate scheduling of foaming work with General Building Contractor to prevent delays of subsequent work by other trades.

3.02 INSTALLATION OF FOAMED-IN-PLACE INSULATION

- A. Install foamed-in-place insulation from top of wall as laying of masonry wall coursing progresses. Fill cores in approximately 5 foot lifts around the entire wall area.
- B. Fill all open CMU cores.

END OF SECTION 07 21 19

SECTION 07 22 00 – NAILBASE ROOF INSULATION

PART 1 – GENERAL

1.01 WORK INCLUDES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Work includes:
 - 1. The work shall consist of covering all areas shown on the drawings with nailbase roof insulation.

1.02 RELATED WORK

- A. Section 05 31 00 – Steel Decking
- B. Section 07 41 00 - Standing Seam Metal Roof System

1.03 QUALITY ASSURANCE

- A. Each bundle of nonventilated panels shall bear an Underwriters Label (see below). The manufacturer will be subject to regular inspection by U.L. to confirm that the approved materials are used in the panel.

B. The insulation shall be classified by Underwriters Laboratories Inc. as Shingle Decking Accessories for use with any Class A, B or C asphalt glass-mat or asphalt organic shingles.

1.04 REFERENCES

A. Foam insulation shall comply with FMRC Std. 4450/4470.

1.05 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-03 Manufacturer's product data.
2. SD-04 Samples: Submit sample of nailbase insulation at T & G edging.

1.07 DELIVERY STORAGE AND HANDLING

A. The nailbase insulation shall be protected in transit by stretch wrapping and by truck tarps.

B. Material stored at the jobsite shall be covered with tarps.

108 PROJECT/SITE CONDITIONS

A. If material is stored at the jobsite, a reasonable level, drained storage area shall be provided.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. For basis of design, the plans are based on Cornell Corp. ThermaCal, non-vented, nail base insulated roof panels.

B. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications.

1. Atlas Roofing Corp., Atlanta, GA
2. Johns Manville, Denver, CO

2.02 MATERIALS

A. Description of System:

1. The insulation shall be a factory assembled panel consisting of a 5/8" oriented strand board top surface, polyisocyanurate insulation and a layer of felt on the bottom.
2. The overall thickness of the roof insulation shall be 4-5/8" with a 'Long Term Thermal Resistance' (LTTR) R value = 24.2.
3. Panels shall be a nominal 48" x 96" and shall be accurately trimmed to length and width after assembly.
4. Foam insulation edges shall be to tongue & groove.
5. OSB topside sheathing shall be rabbetted to allow clearance between the wood on adjoining panels.

B. Insulation fasteners shall be as recommended by the insulation manufacturer for use with the supporting structural roof deck shown in the plans.

PART 3 – EXECUTION

3.01 PREPARATION

A. The structural roof deck shall be smooth and level and free of water or debris before the ventilated insulation is installed.

3.02 INSTALLATION

B. Installation shall follow the manufacturer's written installation instructions shipped with the material. Protect work from exposure to moisture damage and deterioration, primarily by prompt installation of the roofing, sheet metal and waterproofing work.

END OF SECTION 07 22 00

SECTION 07 27 26 – FLUID-APPLIED MEMBRANE AIR BARRIER

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

B. This Section specifies a water-resistant fluid-applied air and vapor barrier in exterior masonry wall assemblies.

C. Spray-applied polyurethane foam.

1.02 RELATED WORK BY OTHERS

A. Section 04 20 00 – Unit Masonry

1.03 PERFORMANCE REQUIREMENTS

A. Air Barrier Membrane Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) when tested according to ASTM E 2178.

1.04 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Requirements.

1. SD -03 Product Data: Submit manufacturer's product data, installation instructions, and manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

2. SD-07 Quality Assurance Program: Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification number of installers.

3. SD-08 Manufacturer's Instructions

4. SD-09 Field Reports: Submit reports indicating that manufacturer's field representative has inspected and verified that the air barrier membrane has been applied according to the manufacturer's recommendations.

1.05 QUALITY ASSURANCE

A. Air Barrier Installer Qualifications: Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified according to the ABAA Quality Assurance Program.

B. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing air and vapor barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

C. Accredited Laboratory Testing for Materials: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).

D. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.

1.06 QUALITY CONTROL

A. The Contractor shall engage and pay for the services of an experienced air barrier inspector to oversee the sequencing and installation of the air barrier component materials and assemblies, to oversee the proper joining and sealing of the materials and assemblies, to oversee the sealing of penetrations of the air barrier materials and assemblies, and to instruct the subcontractors on the above.

B. Documentation and Reporting

1. Installers shall document the entire installation process on daily job site reports. These reports include information on the Installer, substrates, substrate preparation, products used, ambient and substrate temperature, the location of the air barrier installation, the results of the quality control procedures, and testing results.

1.07 CONTRACTOR RESPONSIBILITIES

A. Coordination of Sub-Contractor(s)

1. The Contractor shall provide coordination between the Sub-Contractors involved in the construction of the air barrier system, coordinate the sequence of construction to ensure continuity of the air barrier system joints, junctures, penetrations, and transitions between materials and assemblies of materials and products from substructure to walls to roof. The Contractor shall provide quality assurance procedures, testing and verification as specified.

B. Pre-Construction Conferences

1. The Contractor shall organize pre-construction conferences between the sub-contractors involved in the construction of or penetration of the air barrier system and the air barrier inspector to discuss where each sub-contractor begins and ends, the sequence of installation, and each sub-contractor's responsibility to ensure airtight joints, junctures, penetrations and transitions between materials, products, and assemblies of products specified in the different sections to be installed by the different sub-contractors.

C. Construction Mock-Up

1. The Contractor shall apply air barrier membrane to masonry mock-up panel provided by others.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air and vapor barrier membrane manufacturer. Protect stored materials from direct sunlight.
- C. Handle materials according to manufacturer's recommendations.

1.09 PROJECT CONDITIONS

- A. Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer.
- B. Field Conditions: Do not install air and vapor barrier in snow, rain, fog, or mist without temporary protection and supplemental heat as required. Do not install air and vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer. Apply membrane to a surface dry substrate, or according to manufacturer's recommendations.

1.10 WARRANTY

- A. Material Warranty: Provide manufacturer's standard product warranty, for a minimum 3 years from date of Substantial Completion.
- B. Installation Warranty: Provide air barrier subcontractor's 2 year warranty from date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 – PRODUCTS

2.01 MATERIALS – GENERAL

- A. Fluid-Applied Air and Vapor Barrier: Fluid-applied proprietary materials as specified. Use regular or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Provide related accessories including primer, seam tape, mastic, fluid and sealant recommended by manufacturer.

B. Spray-Applied Polyurethane Foam: ASTM E-84, quick curing, two component spray polyurethane foam insulation containing no CFC's, VOC's, formaldehyde or Penta-BDE's.

2.02 MANUFACTURERS

A. Fluid-applied air and vapor barrier: Subject to compliance with requirements, provide one of the following:

1. Carlisle Coatings and Waterproofing:
 - a. Fluid-Applied Air and Vapor Barrier Membrane: Barriseal, 40 mils thick (dry).
 - b. Water-Based Primer: CCW-AWP Water-Based Primer.
 - c. Solvent-Based Primer: CCW-702 Solvent-Based Primer.
 - d. Solvent-Based Aerosol Primer: CAV-GRIP.
 - e. Mastic: CCW-704 Solvent-Based Rubberized Asphalt Mastic.
 - f. Sealants: CCW-703 Vertical Grade Liquiseal membrane or CCW-201 two component polyurethane sealant.
 - g. Counterflashing for Masonry Through-Wall Flashings: CCW-705.
 - h. Website: www.carlisle-ccw.com.
2. Grace Construction Products:
 - a. Fluid-Applied Air and Vapor Barrier: Perm-A-Barrier Liquid, 60 mils thick (wet).
 - b. Water-Based Primer for Flashing, Transition Strip and Detail Membrane: Perm-A-Barrier WB Primer.
 - c. Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: Bituthene Primer B-2 and Bituthene Primer B2 LVC.
 - d. Through-Wall Flashings or Shelf Angle Flashings: Perm-A-Barrier Wall Flashing.
 - e. Mastics, Adhesives and Tapes: As recommended by Grace Construction Products.
 - f. Transition Strip: Perm-A-Barrier Detail Membrane and Perm-A-Barrier Wall Flashing.
 - g. Termination Mastic: Bituthene Liquid Membrane and as recommended by Grace Construction Products.
 - h. Window Flashing and Detail Membrane: Perm-A-Barrier Detail Membrane and Perm-A-Barrier Wall Flashing.
 - i. Website: www.na.graceconstruction.com.
3. Hohmann & Barnard, Inc:
 - a. Fluid-Applied Air and Vapor Barrier Membrane: Textroflash Liquid Air and Vapor Barrier, 60 mils (wet), 40 mils (dry) approximately 25 square feet per gallon.

- b. Flashing and Transition Membrane: Hohmann and Barnard Textroflash Green, Spun-bonded polypropylene membrane with adhesive and release paper, 40 mils.
 - c. Base Flashing: Hohmann and Barnard Flex-Flash Flashing, 40 mil with pressure sensitive adhesive.
 - d. Primers: As recommended by manufacturer.
 - e. Mastics: As recommended by manufacturer.
 - f. Website: www.h-b.com.
- 4. Protective Coatings Technology, Inc.:
 - a. Fluid-Applied Air and Vapor Barrier Membrane: Poly-Wall AirLok or AirLok Flex as recommended by manufacturer, 8-12 mils (dry) (50-80 square feet per gallon inversely related to texture and porosity of wall surface).
 - b. Water-Based Primer: As recommended by manufacturer.
 - c. Solvent-Based Primer: Poly-Wall AirLok or AirLok Flex as recommended.
 - d. Counterflashing for Masonry Through-Wall Flashings: Poly-Wall CrackGuard.
 - e. Mastics, Adhesives and Tapes: As recommended by manufacturer.
 - f. Website: www.poly-wall.com.
- 5. Tremco, Inc.:
 - a. Fluid-Applied Air and Vapor Barrier Membrane: ExoAir 120SP/R (spray-applied and ExoAir 120R (roller-grade), 60 mils (wet) (25 square feet per gallon for sheathing panels and 20 square feet per gallon for unparged masonry walls). ExoAir 220R (roller-grade), 70 mils (wet).
 - b. Water-Based Primer: ExoAir 10 WB Primer.
 - c. Solvent-Based Primer: ExoAir 10 Primer.
 - d. Transition Strips: ExoAir 110/110 LT.
 - e. Counterflashing for Masonry Through-Wall Flashings: ExoAir TWF, Proglaze ETA.
 - f. Mastics, Adhesives and Tapes: ExoAir Termination Mastic.
 - g. Detail Sealants: Tremflex 834 acrylic latex sealant, Dymonic FC polyurethane sealant, or Spectrem 1 silicone sealant.
 - h. Adhesives and Tapes: As recommended by manufacturer.
 - i. Website: www.tremcosealants.com.
- 6. W. R. Meadows, Inc.:
 - a. Fluid-Applied Air and Vapor Barrier: Air-Shield LM and Air Shield LM All Season (for cold temperature applications), 60 mils (wet), 45 mils (dry).
 - b. Detailing Strips: Air-Shield Self-Adhering Air Barrier.
 - c. Water-Based Primer: Mel-Prime WB.
 - d. Solvent-Based Primer: Mel-Prime VOC and Mel-Prime NE.

- e. Counterflashing for Masonry Through-Wall Flashings: Air-Shield Thru-Wall Flashing.
- f. Mastics, Adhesives and Tapes: Pointing Mastic.
- g. Website: www.wrmeadows.com.

B. Spray Polyurethane Foam Insulation

- 1. Commercial Thermal Solutions, Inc., Spring Lake, NJ; 'Tiger Foam'
- 2. BASF

2.03 AUXILIARY MATERIALS

A. Sealant at Transitions in Substrate and Connections to Adjacent Elements: Low-modulus pre-cured silicone extrusion and sealant for bonding extrusions to substrates; Tremco Silicone Extruded Sheet by Tremco, Proglaze ETA by Tremco, or Bondaflex Silbridge 300 by May National Associates.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.

B. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.

D. Ensure that the following conditions are met:

- 1. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
- 2. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
- 3. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
- 4. Verify substrate is surface dry. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test. Surface dry is an acceptable substrate condition if acceptable to the manufacturer.
- 5. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.

6. Notify Architect in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.

3.02 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air and vapor barrier application. Mask off adjoining surfaces to prevent overspray and spillage.
- B. Prime substrate for application of sheet membrane transition strips as recommended by manufacturer and as follows:
 1. Prime masonry, concrete substrates with conditioning primer.
 2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
 3. Prime wood, metal, and painted substrates with primer.
 4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air and vapor barrier and at protrusions.
- C. Prime substrate for application of fluid-applied air and vapor barrier if recommended by manufacturer based on project conditions and as follows.

3.03 INSTALLATION

- A. Air and Vapor Barrier Installation: Install transition strip materials and fluid-applied air and vapor barrier to provide continuity throughout the building envelope. Install materials according to manufacturer's recommendations and as follows, unless manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials:
- B. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.
- C. Apply primer for fluid-applied air and vapor barrier as recommended by fluid-applied air and vapor barrier manufacturer. Based on manufacturer's recommendation, no primer may be required for the fluid-applied materials.
- D. Apply fluid-applied air and vapor barrier using equipment and methods recommended by manufacturer, to achieve a dry film thickness as recommended by the manufacturer.
- E. Apply fluid-applied air and vapor barrier and transition strips to shed water naturally without interception by a sheet edge, unless that edge is sealed with permanently flexible termination mastic.

F. Position subsequent sheets of transition strips applied above so that membrane overlaps the membrane sheet below by a minimum of 2 inches (50 mm), unless greater overlap is recommended by manufacturer. Roll into place with roller.

G. Overlap horizontally adjacent pieces of transition strips a minimum of 2 inch(5mm), unless greater overlap is recommended by manufacturer. Roll seams with roller.

H. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure according to manufacturer's recommendations.

I. Connect air and vapor barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and according to the manufacturer's recommendations.

J. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.

K. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plan and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate or as recommended by the manufacturer.

L. At through-wall flashings, provide an additional 6 inch wide strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane or as recommended by manufacturer . Seal exposed top edge of strip with bead of mastic or as recommended by manufacturer.

1. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
2. At expansion and seismic joints provide transition to the joint assemblies.
3. Apply a bead or trowel coat of mastic along membrane seams at reverse
4. Lapped seams, rough cuts, and as recommended by the manufacturer.
5. At end of each working day, seal top edge of the self-adhered membrane to substrate with termination mastic.
6. Do not allow materials to come in contact with chemically incompatible materials.
7. Do not expose membrane to sunlight longer than as recommended by the manufacturer.
8. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

3.04 INSTALLATION OF SPRAY-APPLIED POLYURETHANE FOAM INSULATION

A. Apply spray polyurethane foam where indicated on the drawings as a component of the building air barrier system.

3.05 FIELD QUALITY CONTROL

A. Owner's Inspection and Testing: Cooperate with Owner's testing agency. Allow access to work areas and staging. Notify Owner's testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

3.06 PROTECTING AND CLEANING

A. Protect air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION 07 27 26

SECTION 07 41 00 – STANDING SEAM METAL ROOF SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDES

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

B. Work Includes:

1. Standing seam metal roof panels.
2. Fasteners, clips, furring channels, flashings, and miscellaneous accessories.
3. Gutters & downspouts
4. Ice Guards
5. Sheet underlayment.
6. Drip edge flashing and miscellaneous flashing components associated with the standing seam metal roofing.
7. Prefabricated vent pipe flashings
8. Sealants
9. Roof Tie-Off Devices

1.02 RELATED WORK

- A. Section 07 22 00 – Nail Base Roof Insulation
- B. Section 07 60 00 – Flashing & Sheet Metal
- C. Section 07 71 23 –Manufactured Gutters & Downspouts
- D. Division 22 – Plumbing: Roof vent penetrations
- E. Division 23 – HVAC: Roof top mounted equipment and duct penetrations.

1.03 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-02 Shop Drawings: Submit shop drawings consisting of catalog cuts, design and erection drawings, finish specification, and other data necessary to clearly describe design materials, sizes, layouts, construction details, fasteners, and erection.
2. SD-03 Product Data: Submit manufacturer's specifications and installation instructions.

3. SD-04 Samples: Submit full panel width, 12 inches long including mechanically seamed standing seam and in selected color.

4. SD-06 Test Reports: Submit test reports prepared by (UL) Underwriters

Laboratories, Inc. indicating wind uplift rating of proposed roof system.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Ten years minimum experience in factory fabrication of standing seam roofs.

2. All roof panels shall be roll-formed at the manufacturer's prime manufacturing location except where panels exceed maximum length permitted to truck panels to the jobsite.

B. Applicator Qualifications: Five years minimum experience in application of standing seam roofs.

1.05 PERFORMANCE REQUIREMENTS

A. No water penetration of the panel assembly shall be permitted when tested at 20 psf pressure for 15 minutes according to ASTM Test Procedure E331.

B. Deflection shall be limited to L/240 for positive loading.

1. The panels shall withstand a 250lb. concentrated load applied to a four square inch area at the center of the panel at mid-span between supports without panel deformation, rib buckling or panel sidelap separation that will adversely affect the weather tightness of the system.

1.06 DELIVERY AND STORAGE

A. Materials shall be delivered to the site in a dry and undamaged condition and unloaded per the manufacturer's instructions. The installer shall inspect materials for damage and strain upon their arrival at the site. Materials shall be stored out of contact with the ground in weathertight coverings to keep them dry per the manufacturer's recommendations. Storage accommodations shall provide good air circulation and protection from surface staining.

1.07 WARRANTY

A. Furnish manufacturer's standard 20-year warranty stating architectural fluorocarbon finish will be;

1. Free of fading or color change in excess of 5 NBS units as measured per ASTM D 2244-68.
 2. Will not chalk in excess of numerical rating of 7 when measured according to standard procedures specified in ASTM D 659-74.
 3. Will not peel, crack, chip or delaminate.
- B. Furnish manufacturer's full system No Dollar Limit (NDL) written warranty signed by applicator and manufacturer for 20-year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight conditions. Warranty excludes gutters, downspouts and vented flashings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. For basis of design, the plans are based on Peterson Aluminum PAC-CLAD 'Tite-Loc'.
- B. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications. Manufacturer's wishing to submit alternate metal roofing products shall submit product data sheets and/or specifications.

1. Firestone Una-Clad
2. Berridge Manufacturing Co.; Houston, TX
3. AEP Span, Dallas, TX;

2.02 MATERIALS

A. Roof Panels

1. General: Metal roof panel system shall consist of a mechanically field-seamed to a 90 deg. lock.
2. Leg Height: 2 inches
3. Steel: AISI G90 hot dipped galvanized, extra-smooth primed and finished on one side.
4. Description: 24 gauge roll-formed panels with concealed anchor clips. There shall be no exposed fasteners except to fasten flashings, at fixing points or as indicated on the drawings.
5. Center to center panel width: 18 inches
6. Individual panels shall be removable for replacement of damaged material without disturbing adjacent panels.
7. Fabricate panels in full length with no end laps.

8. Provide factory eave notching where conditions require fascia returns.
 9. Flashing and trim shall be of the same material, gauge, finish, and color as the panels.
- B. Color: Match Peterson Aluminum 'Colonial Red'
- C. Accessories
1. Clip System: Provide manufacturer's standard 18 gage hold-down clips.
 2. Fasteners: Self-drilling, self-tapping pancake head Phillips drive screw, UL 90 rated fasteners as recommended by roof system manufacturer.
 3. Closure Strips: Shop fabricated prefinished, 24-ga. galvanized steel drip edge and soffit channels as indicated on the drawings. Color to match metal panels.
 4. Snowguard Retention Strips: Assembly shall consist of 1-1/2" high prefinished 24-gauge galvanized steel strips for mounting on top edge of standing seams with bolt-on fasteners.
 5. Snowguard strips to be furnished in same color as standing seam roof.
 - a. Manufacturer: Alpine Snowguards w/ 'S-5' Fastener Clips
 6. Prefabricated Vent Pipe Flashings Systems
 - a. Manufacturer: Portals Plus, Inc., Bensenville, IL: Deck-Mates
 - b. Description: Vent pipe flashing shall consist of a stepped profile EPDM pipe boots designed for multiple pipe diameters attached to an aluminum flanged base plate.
 - c. Aluminum base plate shall be shop painted with Kynar 500 coating to match color of standing seam metal roof panels.
- D. Self-Adhering Sheet Membrane Roofing Underlayment
1. Manufacturers
 - a. Carlisle Coatings & Waterproofing: CCW WIP 403HR
 - b. Grace Co. Ice & Watershield
 2. Description: ASTM D-1970, 40 mil sheet membrane comprised of a skid resistant polyethylene film laminated to a thick layer of highly adhesive rubberized asphalt with a siliconized release sheet. Roofing underlayment shall meet or exceed UL-790 Tests for Fire Resistance of Roof Coating Materials Class A & C.
- E. Gutters: Refer to Section 07 71 12 – Manufactured Gutters & Downspouts
- E. Metal Flashing Accessories: Refer to Section 07 60 00 – Flashing & Sheet Metal.

F. Sealants

1. Must not contain oil, asbestos, or asphalt.
2. Factory-applied sidelap sealant: Non-drying, non-skinning, synthetic polymer-based designed for metal-to-metal concealed joints.
3. Field-applied panel end sealant: Extruded polymeric butyl tape, non-skinning and not easily displaced under compression. Webbed mastic by Tremco or equal.
4. Exposed Sealant: One component, skinning, polyurethane joint sealant. Color to be coordinated with that of panel. Dymonic by Tremco or equal.

G. Roof Tie-Off Devices: Re-usable Two-way Universal Standing Seam Clamp™, all steel construction with zinc electroplate finish.

1. Manufacturer: Preferred Safety Products, Inc., Denver, CO
2. Quantity: Provide three (3) clamp units to be turned over to the Owner as part of the project close-out requirements.

PART 3 - EXECUTION

3.01 INSPECTION

- A. The installer shall examine the building to verify that the structure is ready for roofing installation.
- B. All structural supports shall be in place and all sag rods, diagonal bracing and connections shall be tightened before work can proceed.
- C. Field check dimensions and check support alignment with a taut string or wire; support misalignment will cause panel “oil-canning”.
- D. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Self-Adhering Ice & Water Shield Sheet Membrane Underlayment Installation

1. Apply over all roof areas scheduled to receive standing seam metal roofing.
2. Overlap seams and joints minimum 6” as recommended by manufacturer.

B. Standing Seam Metal Roofing

1. Install metal panel system according to approved erection drawings and instructions.
2. All attachments shall allow for thermal expansion and contraction of the roofing panels.

3. Where permitted by roof manufacturer, install panels in one continuous length from ridge to eave.
4. Seal the top and bottom of the metal closures with butyl tape (7/8" x 1/8") caulking or equal.
5. Protect installed panels from abuse by other trades. The general contractor shall be responsible for protecting the roofing from wet cement, plaster, and painting operations. The installer shall provide walkboards in heavy traffic areas to prevent damage to the panels.

C. Prefabricated Vent Pipe Flashings Systems

1. Prepare surface of metal roof panel as recommended by pipe flashing manufacturer. Apply watertight sealant and self-sealing stainless steel fasteners as recommended by manufacturer.
2. Install clamping ring and seal perimeter of pipe penetration.

3.03 DAMAGED MATERIAL AND CLEANING

- A. Replace damaged panels and other components of work, which cannot be repaired by, finish touch-up or similar minor repair.
- B. Wipe down each area after erection is complete for final acceptance.

3.04 WATERTIGHTNESS INSPECTIONS

- A. Prior to project close-out, complete inspection of all work under this section to verify that installation of roof panels, trim, flashings and accessories comply with the manufacturer's requirements for warranty.
- B. Test all roof penetration flashings for watertightness and repair installations where necessary.

END OF SECTION 07 41 00

SECTION 07 46 00 – PREFINISHED METAL SOFFIT PANELS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, material, tools, equipment and services for all preformed metal panels including:

1. Prefinished metal soffit panels
2. Trim accessories
3. Furring strips
4. Fasteners

1.02 RELATED SECTIONS

- A. Section 07 60 00 – Flashing and Sheet Metal
- B. Section 09 22 16 – Non-load Bearing Metal Wall Framing

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer to have a minimum of 3 years experience in manufacturing panels of this nature.
- B. Installer's Qualifications: Installation of panels and accessories shall be performed by installers with a minimum of two years experience in panel projects of this nature.

1.04 SUBMITTALS

- A. SD-02 Shop Drawings: Submit complete shop drawings and erection details to architect for review prior to fabrication.
- B. SD-04 Samples: submit one 12" long sample panel of each color selected by architect.

1.05 WARRANTY

- A. Metal panel manufacturer, upon final acceptance of the work, shall furnish a warranty covering bare metal against rupture, structural failure, and perforation due to normal atmospheric corrosion exposure for a period of 20 years.
- B. Metal panel manufacturer to furnish warranty covering panels furnished with factory finish against cracking, checking, blistering, peelings, flaking, chipping, chalking, and fading for a period of 20 years.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Provide prefinished metal soffit panels from one of the following manufacturers:
 - 1. Una-Clad by Copper Sales, Anoka, MN; UC-500
 - 2. Pac-Clad (Peterson Aluminum Corp.), Elk Grove Village, IL: ‘Soffit Flush’ vented.
 - 3. McElroy Metal Inc.; Bossier City, LA: Marquee Series
 - 4. AEP/Span Metal Corporation; Dallas, TX

2.02 MATERIALS

- A. Soffit Panels
 - 1. Panel Profile: Vented 12” wide x 1” deep roll formed of .024” galvanized coil-coated steel with flanged panels for concealed fastening.
 - 2. Finish: Kynar 500
 - 3. Color: Match Peterson Aluminum ‘Colonial Red’
- B. Furring Channels
 - 1. Roll-formed, 20-ga. hat-shaped corrosion resistant steel, 7/8” deep.

2.03 FABRICATION

- A. Roll form panels in continuous lengths, full length of detailed runs.
- B. Fabricate trim, flashing and accessories to detailed profile from same material as panel.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Install panels so that they are weathertight, without waves, warps, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
- B. Install panels according to manufacturer’s instruction and shop drawings.
- C. Provide concealed anchors at all panel attachment locations.
- D. Install panels level and straight with seams conforming to design as indicated.

3.03 CLEANING, PROTECTION

- A. Dispose of excess materials and remove debris from site.
- B. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the Architect, any work that becomes damaged prior to final acceptance.
- C. Touch-up minor scratches and abrasions.

END OF SECTION 07 46 00

SECTION 07 60 00 – FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Conform to profiles and sizes shown on drawings, and comply with "Architectural Sheet Metal Manual" by SMACNA, for each general category of work required.
 - 1. Metal flashing and counter flashing as indicated on the drawings.
 - 2. Roof edge fascia
 - 3. Miscellaneous sheet metal accessories.

1.02 RELATED SECTIONS

- A. Section 04 20 00 – Unit Masonry: Metal drip edge at thru-wall flashing
- B. Section 07 41 00 – Standing Seam Metal Roofing
- C. Section 07 71 23 – Gutters & Downspouts
- D. Section 08 84 00 – Insulated Translucent Panels: Sill Flashing

1.03 SUBMITTALS

- A. SD-02 Shop drawings showing layout, profiles, method of joining, anchorage details, etc.

1.04 PERFORMANCE

A. Performance: Watertight and weatherproof performance of flashing and sheet metal work is required.

1.05 WARRANTY

A. Provide manufacturers 20 year written guarantee covering film integrity, fading, chalking.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Prefinished Hot-Dipped Galvanized Steel:

1. ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality, mill phosphatized.
2. Gauge: 24-ga. unless indicated otherwise on the drawings.
3. Finished 1 side with Kynar based fluropolymer coating, (color as selected by Architect from manufacturers standard Kynar color) and wash coat on back surface. Provide strippable plastic film on face.
4. Manufacturers
 - a. Petersen Aluminum Corporation "Pac-Clad".
 - b. Firestone "Una-Clad".
 - c. AEP Span
 - d. MetalEra, Inc.

B. Aluminum Sheet: ASTM B 209, alloy 3003-H14, 0.032 inch (20 ga.).

1. Finished 1 side with Kynar based fluropolymer coating, (color as selected by Architect from manufacturers standard Kynar color) and wash coat on back surface. Provide strippable plastic film on face.

C. Stainless Steel: ASTM A 240/A 240M, Type 304

2.02 FABRICATION

A. Fabricate sheet metal with flat-lock seams; solder with type solder and flux recommended by manufacturer, except seal aluminum seams with epoxy metal seam cement and, where required for strength, rivet seams and joints.

B. Coat backside of fabricated sheet metal with 15-mil sulfur-free bituminous coating, SSPC-Paint 12, where required to separate metals from corrosive substrates, including cementitious materials, wood or other absorbent materials; or provide other permanent separation.

C. Provide for thermal expansion of running sheet metal work by overlaps of expansion joints in fabricated work. Where required for watertight construction, provide hooked flanges filled with polyisobutylene mastic for 1-inch embedment of flanges. Space joints at intervals of not more than 50 feet for steel, 24 feet for copper or stainless steel, or 30 feet for zinc alloy or aluminum. Conceal expansion provisions where possible.

D. Provide joint covers at 10-foot intervals with no exposed fasteners on face.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Anchor work in place with non-corrosive fasteners, adhesives, setting compounds, tapes and other materials and devices as recommended by manufacturer of each material or system. Provide for thermal expansion and building movements. Comply with recommendations of "Architectural Sheet Metal Manual" by SMACNA.

B. Seal moving joints in metal work with elastomeric joint sealants, complying with requirements specified in Division 7 Section "Joint Sealants."

C. Clean metal surfaces of soldering flux and other substances which could cause corrosion.

D. Nail flanges of expansion joint units to substrates at spacing of 6 inches o.c.

E. Composition Stripping: Cover flanges (edges) of work set on bituminous substrate with 2 courses of glass fiber fabric (ASTM D-1668) set in and covered with asphaltic roofing cement.

END OF SECTION 07 60 00

SECTION 07 71 23 – MANUFACTURED GUTTERS & DOWNSPOUTS

THIS SECTION INCLUDES SHOP AND FIELD FABRICATED FLASHING AND SHEET METAL WORK RELATED TO OR USED IN CONJUNCTION WITH ROOFING WORK AND THE GENERAL WATERPROOFING INTEGRITY OF THE BUILDING.

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Work Includes: Shop fabricated, prefinished aluminum gutters and downspouts.

1.02 RELATED SECTIONS

- A. Section 07 41 00 – Standing Seam Metal Roofing
- B. Section 07 60 00 – Flashings and Sheet Metal

1.03 SUBMITTALS

- A. SD-02 Shop drawings showing layout, profiles, method of joining, anchorage details, etc

1.04 WARRANTY

- A. Provide manufacturers 20 year written guarantee covering film integrity, fading, chalking.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Prefinished Aluminum: .063 inch aluminum, commercial quality, primed and finished one side with Kynar based fluopolymer coating. Provide strippable plastic film on face.

- 1. Peterson Aluminum Corporation "Pac-Clad".
- 2. Firestone's "Una-Clad".
- 3. Metal Era, Inc.

2.02 COMPONENTS

A. Provide all necessary components and accessories necessary for a complete installation including the following:

1. Gutters: Rectangular shaped as shown on drawings.
2. Downspouts: Rectangular with open face.
3. Gutter support brackets, downspout straps

2.03 FABRICATION

A. Fabricate gutters and downspouts to profiles indicated on drawings.

B. Field measure site conditions prior to fabricating work.

C. Hem all exposed sheet metal edges.

D. Coat backside of fabricated sheet metal with 15-mil sulfur-free bituminous coating, SSPC-Paint 12, where required to separate metals from corrosive substrates, including cementitious materials, wood or other absorbent materials; or provide other permanent separation.

E. Provide hard plastic spacers where downspout is anchored to steel column or masonry wall surface.

F. Where indicated on the drawings, fabricate downspouts with matching aluminum 'false back' interior liner to maintain continuous vertical downspout past masonry wall projections.

G. Provide for thermal expansion of running sheet metal gutters by watertight overlaps of expansion joints in fabricated work. Space joints at intervals of not more than 30 feet. Conceal expansion provisions where possible.

2.04 FINISH

A. Kynar 500 coating.

B. Color: Match Peterson Aluminum 'Colonial Red'

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install gutters, collector heads and downspouts according to manufacturer's instructions.

B. Seal moving joints in metal work with elastomeric joint sealants, complying with requirements specified in Division 7 Section "Joint Sealants."

C. Clean metal surfaces of soldering flux and other substances, which could cause corrosion.

END OF SECTION 07 71 23

SECTION 07 84 00 – FIRESTOPPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

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

1.02 SUMMARY

A. This Section includes firestopping for the following:

1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
4. Sealant joints in fire-resistance-rated construction.

1.03 RELATED SECTIONS

- A. Section 07 92 00 – Joint Sealers
- B. Division 22 – Plumbing: Pipe penetrations through fire rated partitions
- C. Division 23 – HVAC: Pipe and duct penetrations through fire rated partitions
- D. Division 26 – Electrical : Conduit penetrations through fire rated partitions

1.04 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
- B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:

1. Where firestop systems protect penetrations located outside of wall cavities.
2. Where firestop systems protect penetrations located outside fire-resistive shaft enclosures.
3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
4. Where firestop systems protect penetrating items larger than a 4 inch (100 mm) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

F. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

1.05 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

1. SD-03 Product data for each type of product specified.

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water (2.5 Pa) is maintained at a distance of 0.78 inch (20 mm) below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.
3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water (2.5 Pa), as measured 0.78 inch (20 mm) from the face exposed to furnace fire. Provide systems complying with the following requirements:
 - a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
 - b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

B. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

PART 2 - PRODUCTS

2.01 FIRESTOPPING

A. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by

the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to insulation, forming/damming materials, fire-rated formboard, joint fillers, primers, collars, and steel sleeves.

2.02 MANUFACTURERS

A. Fill materials for through-penetration firestop systems and fire resistive elastomeric sealants. Provide one of the following:

1. AD Fire Protection Systems Inc.
2. The Rectorseal Corporation.
3. Tremco Inc.
4. International Protective Coatings Corp.
5. 3M Fire Protection Products.
6. Dow Corning Corporation.
7. Hilti Construction Chemicals, Inc.
8. United States Gypsum Co.

B. Applications: Provide firestopping systems composed of materials listed in the UL Fire Resistance Directory that conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate condition, and that the system be symmetrical for wall applications.

1. Applications:
 - a. Metal pipe or conduit (sleeved or unsleeved):
 - 1) Tremco Fyreshield
 - 2) Hilti FS-One.
 - 3) AD Firebarrier Silicone.
 - 4) Rectorseal "Metacaulk 1000
 - b. Insulated metal pipes (sleeved or unsleeved):
 - 1) Tremco Tremstop 1A
 - 2) Hilti FS-One.
 - 3) AD Firebarrier Silicone.
 - 4) Rectorseal "Metacaulk 1000
 - c. Plastic pipes (closed, drain, waste, and vented piping systems):
 - 1) Tremco Tremstop 1A, Tremstop WS, and Fyre-Can.
 - 2) Hilti FS-One, Hilti CP 642 Intumescent collars.
 - 3) AD Firebarrier Silicone, AD Firebarrier collars.
 - 4) Rectorseal "Metacaulk 1000", "BioStop 500+", "Metacaulk Wrap Strip", "BioStop Wrapstrip", Metacaulk fire rated pipe collars, BioStop fire rated pipe collars
 - d. Single and bundled cables (sleeved or unsleeved):
 - 1) Tremco Tremstop 1A
 - 2) Hilti FS-One, Hilti CP 642 Intumescent Collars.
 - 3) AD Firebarrier Silicone.
 - 4) Rectorseal "Metacaulk 1000", "BioStop 500+".

- e. Large openings for multiple penetrating items, cable trays and electrical busway:
 - 1) Tremco Tremstop pillows.
 - 2) Hilti FS 657 Fire Block, Hilti FS-One, Hilti FS 635.
 - 3) AD Firebarrier Silicone.
 - 4) Rectorseal Metacaulk Mortar, Bio K-10 Mortar, Metacaulk Firestop Pillows, BioStop Firestop Pillows.
- f. Construction joints:
 - 1) Tremco Tremstop Acrylic, Fyre-Sil.
 - 2) Hilti FS-One, FS 601, FS 604.
 - 3) AD Firebarrier mortar.
 - 4) Rectorseal "Metacaulk 1000", "BioStop 500+", "Metacaulk 1100", "BioStop 700", "Metacaulk 1200", "BioStop 750".
- g. Accessories:
 - 1) Forming/Damming Materials: Mineral fiberboard of type recommended by manufacturer to maintain the hourly rating.
 - 2) Primer, sealant and solvent cleaner as recommended by manufacturer.
- h. Were subject to movement, firestop products used shall remain flexible to allow for normal movement of building structure and penetrating items without affecting the integrity of the firestop system.

2.03 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods

used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.02 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.03 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure

contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.04 FIELD QUALITY CONTROL

A. Do not proceed to enclose firestopping with other construction until work has been inspected by authorities having jurisdiction, if required.

B. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.05 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 07 84 00

SECTION 07 92 00 – JOINT SEALANTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Work included in this section includes, but is not necessarily limited to:
 - 1. Expansion and control joints in masonry walls (interior and exterior).
 - 2. Concrete slab movement joints.
 - 3. Hollow metal frames to wall,
 - 4. Mechanical pipe penetrations (where exposed or fire rated).
 - 5. Exterior HVAC grilles and louvers to wall.
 - 6. Plumbing fixtures to wall
 - 7. Countertops to wall
 - 8. Window stools to wall and aluminum window framing.
 - 9. Caulking of miscellaneous joints as indicated on the drawings.

1.02 SUMMARY

- A. This Section includes joint sealants for the applications indicated in the joint sealant schedule at the end of Part 3.
- B. Related Sections: The following sections contain information related to this section:
 - 1. Division 9 Section “Gypsum Board Assemblies” for partitions with STC ratings.
 - 2. Division 9 Section “Tile” for sealants adjacent to tile.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

1.04 SUBMITTALS

- A. General: Submit according to Division 1 procedures.
- B. Product Data: Product Data for each specified sealant.
- C. Samples For Initial Selection: Provide samples representing colors selected for products of types indicated.

D. Maintenance data for each product specified, to include in Operating and Maintenance Manual specified in Division 1.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

- B. Colors: Provide color of exposed joint sealants to comply with the following:
1. Provide selections made by engineer from manufacturer's colors indicated in joint sealant schedule for products of type indicated.

2.02 CHEMICALLY CURING ELASTOMERIC JOINT SEALANTS

A. Multicomponent Nonsage Urethane Sealant ES-1.

1. Available Products:
 - a. Sonneborn, Division of Chemrex Inc.; NP-2.
 - b. Tremco equivalent
 - c. Sealtex equivalent
 - d. Or approved equal
2. Type and Grade: M (Multicomponent) and NS (Non Sag).
3. Class 25
4. Uses Related to Exposure: NT (Non Traffic).
5. Uses Related to Joint Substrates: M,G,A, and O.

B. Multicomponent, gun grade, polyurethane sealant ES-2.

1. Available Products:
 - a. Tremco THC_901.
 - b. Sonneborn equivalent
 - c. Sealtex equivalent
 - d. Or approved equal
2. Type and Grade: M (Multi-component) Grade P.
3. Class 25.
4. Use Related to Exposure: T (Traffic).
5. Use Related to Joint Substrates: M, and O

C. Multicomponent, gun grade, polyurethane sealant ES-3.

1. Available Products:
 - a. Sonneborn, Division of Chemrex, Inc.: SL2.
 - b. Tremco equivalent
 - c. Sealtrex equivalent
 - d. Or approved equal
2. Type and Grade: M (Multicomponent); Grade P.
3. Class 25.
4. Use Related to Exposure: T (Traffic).
5. Use Related to Joint Substrate: M and O.

2.03 LATEX JOINT SEALANTS

A. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

B. Acrylic-emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.

C. Latex Sealant LS-1

1. Available Products:
 - a. Tremco; Tremflex 834
 - b. Sonolac, Sonneborn, Division of Chemrex, Inc.
 - c. Sealtex equivalent
 - d. Or approved equal
2. Type and Grade: Type P; Grade NF.
3. Class 12.5.
4. Use Related to Exposure: NT.
5. Use Related to Joint Substrate: O.

2.04 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance;

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

2.05 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean concrete, masonry, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

- a. Do not leave gaps between ends of joint fillers.

- b. Do not stretch, twist, puncture, or tear joint fillers.

- c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

F. All joint sealants used on fire rated wall assemblies (3-hour occupancy separation) shall be U.L. listed materials suitable for use in a tested and listed assembly.

3.04 CLEANING

Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

3.06 JOINT SEALANT SCHEDULE

A. Joint Sealant Application JS-1, exterior vertical construction joints.

1. Joint Sealant: ES-1.
2. Joint Sealant Color: Match adjacent material color.

B. Joint Sealant Application JS-2, exterior horizontal traffic joints in cast-in-place concrete slabs.

1. Joint Sealant: ES-2.
2. Joint Sealant Color: Match color of concrete.

C. Joint Sealant Application JS-3, exterior butt joints between translucent fiberglass panels.

1. Joint Sealant: ES-1.
2. Joint Color: Match translucent panel frame color.

D. Joint Sealant Application JS-\$, exterior perimeter joints at frames of doors, windows, and louvers.

1. Joint Sealant: ES-1.
2. Joint Color: Match adjacent frame color.

E. Joint Sealant Application JS-5, interior vertical joints.

1. Joint Sealant: LS-1.
2. Joint color: Match adjacent material color.

F. Joint Sealant Application JS-6, interior perimeter joints at frames of doors, windows, and louvers.

1. Joint Sealant: LS-1.
2. Joint Color: Match adjacent frame color.

G. Joint Sealant Application JS-7, interior expansion, control, contraction, and isolation joints in horizontal traffic tile surfaces.

1. Joint Sealant: ES-3.
2. Joint Sealant Color: Match grout color.

H. Joint Sealant Application JS-8, interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: LS-1.
2. Joint Sealant Color: Match adjacent material color.

END OF SECTION 07 92 00

END OF DIVISION 07 – THERMAL AND MOISTURE PROTECTION

DIVISION 08 – OPENINGS

SECTION 08 11 13 – METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 WORK INCLUDED

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

B. Work Includes:

1. Hollow metal door frames
2. Hollow metal borrowed lite frames.
3. Standard steel doors

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 04 06 50 – Masonry Mortar & Grout: Grout filling of hollow metal frames
- B. Section 04 20 00 – Unit Masonry: Preparation of masonry openings
- C. Section 08 71 00 – Door Hardware
- D. Section 08 80 00 – Glass and Glazing
- E. Section 09 90 00 – Painting: Painting of hollow metal doors and frames

1.03 REFERENCES

- A. ASTM E152 – Methods of Fire Tests of Door Assemblies
- B. DHI – Door Hardware Institute
- C. NFPA 80 – Fire Doors and Windows

1.04 QUALITY ASSURANCE

- A. Conform to requirements of SDI-100.
- B. Fire rated doors and frames to conform to ASTM E152.
- C. Standards: In addition to other specified requirements, comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" ANSI/SDI-100.

1.05 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-02 Shop Drawings: With manufacturer's standard details and specifications for steel doors and frames, submit shop drawings showing application to project, as required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors & Frames

1. Ceco Door Products, Brentwood, TN
2. Curries Company, Mason City, IA
3. Mesker Door Inc., Huntsville, AL
4. Steelcraft, Cincinnati, OH

2.02 HOLLOW METAL DOORS AND FRAMES

A. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

B. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized according to ASTM A 525, with A60 or G60 coating designation, mill phosphatized.

C. Door Core: Foam-in-place polyurethane chemically bonded to all interior surfaces. Foam density shall be 1.8 pcf (min.) with a crush strength of 3,600 psf.

D. Fire-Rated Assemblies: Provide units that display appropriate UL or FM labels for fire-rating indicated.

E. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.

F. Shop Applied Primer:

1. All doors and frames shall be provided with one coat of oven-cured rust-inhibitive enamel or paint suitable as a base for specified finish paints complying with ANSI A224.1.

2.03 FABRICATION – HOLLOW METAL DOORS & FRAMES

A. Fabricate units to be rigid, neat in appearance, and free from defects, warp or buckle.

1. Frames shall be all-welded construction. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible.

B. Prepare steel doors and frames to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping, complying with ANSI A 115 "Specifications for Door and Frame Preparation for Hardware."

1. Reinforce units to receive surface-applied finish hardware to be field applied. Where closer reinforcing is indicated/required, install reinforcing to allow closer to be applied to either face of door/frame.

2. Locate finish hardware as indicated or, if not indicated, per DHI "Recommended Locations for Builder's Hardware."

C. Doors: SDI grades and models specified below or as indicated on drawings or schedules:

1. Interior Doors: ANSI/SDI-100, minimum 16-gage cold-rolled steel faces.
2. Exterior Doors: ANSI/SDI-100, minimum 16-gage galvanized steel faces in compliance with SDI 112.
 - a. Provide thermal rated assemblies with U-factor of 0.09 BTU/hr./sq. ft./deg F. (polyurethane) or better.
 - b. Provide top and bottom closure caps.

D. Frames: Comply with ANSI/SDI-100, of the types and styles indicated, for materials quality, metal gages, and construction details.

1. Prepare frames to receive 3 silencers on strike jambs of single-door frames and 2 on heads of double-door frames. Plug holes temporarily with styrofoam to maintain opening and to maintain space behind frame (when filling with mortar) to allow silencers to be installed (after frames are painted).
2. Provide 26-gage steel plaster guards or mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, masonry or plaster openings.
3. Protect inside faces of frames in plaster or masonry wall construction which are placed with anti-freeze additives, using high-build fibered asphalt emulsion coating.
4. Form exterior frames from 14-gage galvanized steel.

5. Form interior frames from 16-gage galvanized steel.
6. Provide drip moulding on head of all exterior frames.
7. Provide "vandal-resistant" type screws for all glazing stops on exterior of building.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install hollow-metal doors and frames according to manufacturer's instructions and final shop drawings. Coordinate with masonry and stud wall construction.

1. Install frames according to SDI-105.
2. Install fire-rated units according to NFPA Std. No. 80.
3. Finish hardware is specified in Section 08 71 00.

B. Grout all hollow metal frames. Coordinate installation of electrical work routed **thru** hollow metal door frames with electrical trade.

3.02 TOLERANCES (DOORS & FRAMES)

A. Fit doors to frames and floors with clearances specified in ANSI/SDI-100.

B. Maximum Diagonal Distortion: 1/8 inch measured with straight edge, corner to corner.

END OF SECTION 08 11 13

SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

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

B. Work Includes:

1. Prefinished Flush Wood Doors

1.02 RELATED WORK

A. Section 08 11 13 – Standard Steel Doors and Frames

B. Section 08 71 00 – Door Hardware

C. Section 08 80 00 – Glass & Glazing

1.03 QUALITY ASSURANCE

A. Quality Standards: Comply with NWWDA I.S.1 and AWI "Architectural Woodwork Quality Standards".

1. Comply with WIC "Manual of Millwork" for requirements in the door grade comparable to AWI grade indicated and exceeding those in other referenced standards.

1.04 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-02 Shop Drawings: Submit drawings and schedules indicating location, size, face material, and finishes of each door required.
2. SD-03 Product Data
3. SD-04 Samples: Submit two (2) 8” minimum square samples with type of core construction, face material and finish required.

1.05 WARRANTY

A. Manufacturers standard form, signed by manufacturer, supplier, and installer, agreeing to repair or replace defective doors (as defined by reference standards) for the life

of the installation. Replacement shall include cost of finishing and installing replacement door.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide wood doors by one of the following:

1. Graham
2. Algoma Hardwoods, Inc.
3. Eggers Industries.
4. Oshkosh
5. VT Industries

2.02 DOOR TYPES

A. General Wood Door Product Requirements: Provide doors with same exposed surface material on both faces and edges of each door, unless otherwise indicated.

B. Interior Solid Core Doors for Transparent Finish: As follows:

1. Faces: Red Oak rift cut veneer; pairs to be book matched.
2. AWI Grade: Premium, with A Grade veneers. No veneered edge stiles allowed.
3. Construction: PC-5 (Particleboard core, 5-ply), except provide GLC-5 (glued block core 5-ply) for full glass lite doors.

C. Interior Fire-Rated Solid Core Doors: Labeled and listed for rating indicated, by testing and inspection agency acceptable to authorities having jurisdiction, complying with the following requirements:

1. Faces and AWI Grade: Match faces of non-rated doors in same area of building, unless otherwise indicated.
2. Edge Construction: Manufacturer's standard laminated edge construction for improved screw-holding capability and split resistance.
 - a. Provide fire-rated pairs with fire-retardant stiles which are labeled and listed for kinds of applications indicated without formed steel edges.
3. Wood Beads for Light Openings in Fire Doors: Manufacturer's standard lipped-type fire-rated wood-veneer beads matching veneer species of door faces.

4. For fire-rated doors/frames, provide tightly fitted, spring loaded, automatic closing louvers, with operable blades retained by fusible links. Rating label same as door units.
5. Concealed Intumescent (45 min. & 90 min. labeled doors): Where required per Positive Pressure standards, provide fire doors with intumescent concealed behind 1/4" matching hardwood stile edge.

D. Provide solid hardwood blocking with minimum screw pullout strength of 600 lbs. for attachment of all hardware. Thru bolting of hardware is not acceptable. Where thru bolting may be required by Underwriters Laboratory (UL) to maintain fire rating, solid hardwood blocking is still required.

2.03 VISION LITE FRAMES – FIRE RATED DOORS

A. Manufacturers

1. Air Louvers, Inc., Commerce, CA; Model VLF-EZ (single glazing)
2. Anemostat Door Products, Carson, CA; Model 'LoPro'

B. Description:

1. Beveled profile frame assembly manufactured from 20-ga. cold-rolled steel, degreased and phosphatized with a baked on powder coat finish to match door frame paint color. All frames shall be U.L. and W.H.I. listed for use in fire rated doors.
2. Factory prefit and pre-machine doors to fit frame opening sizes indicated and complying with AWI pre-fitting tolerances.

2.04 VISION PANEL CUTOUTS – NONRATED DOORS

A. Cutouts for vision panels and louvers shall be made at the factory.

B. Glass and louvers shall be held in place with factory finished matching wood veneer stops.

2.05 FINISH

A. Transparent Finish: Pre-finish wood doors at factory. Comply with requirements indicated for grade, finish system, staining effect and sheen. Doors are to be completely finished at the factory (point of manufacture) with finish warranty to be provided by the door manufacturer.

1. AWI Grade: Premium.
2. Finish: AWI System TR-6 catalyzed polyurethane.
3. Staining: Match approved sample for color.
4. Effect: Open grain finish.
5. Sheen: Satin-medium rubbed effect.
6. Seal top and bottom of door at factory.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.
 1. Install fire-rated doors in corresponding fire-rated frames according to requirements of NFPA No. 80.
- B. Align and fit door in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.
- C. Prefit Doors: Fit to frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.
- E. Comply with manufacturer's instructions, and with "on-site-care" requirements of AWI Section 1300-6-8 "Care and Handling At Site".

END OF SECTION 08 14 16

SECTION 08 36 13 - SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.01 WORK INCLUDED

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

B. Section includes:

1. Electrically operated overhead sectional doors, insulated flush steel design.
2. Operating hardware and supports.

1.02 RELATED WORK

A. Division 26 – Electrical: Power connections to operators.

1.03 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-02 Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
 - a. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
2. SD-03 Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
 - a. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
 - b. Summary of forces and loads on walls and jambs.
 - c. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
 - d. Programming features for keypad devices.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of 20 PSF, acting inward and outward.
- B. Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 50,000 cycles.

1.05 WARRANTY

- A. Provide manufacturer's standard one (1) year warranty on defects in materials and workmanship, and five (5) years from the date of installation on delamination of insulation from its interior and exterior skins.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Design Product: The design for the insulated steel sectional door system is based on Overhead Door Corp. Model AP 850R-26 (27 ga.). Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Clopay Building Products Co. Model 3730R-23
2. Haas Door Model 816R-26

2.02 MATERIALS

- A. Construct door sections from galvanized, structural-quality carbon-steel sheets complying with ASTM A 653 (ASTM A 653M), commercial quality, with a minimum yield strength of 33,000 psi and a minimum G60 (Z180) zinc coating.

1. Steel Sheet Thickness: 27 gauge.
2. Exterior and Interior Section Face: Flat.

- B. Fabricate door panels from a single sheet to provide sections not more than 24 inches high and nominally 3 inches deep. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.

1. R-Value: R-26
2. For insulated doors, provide door sections with continuous thermal-break construction, separating faces of door.

- C. Enclose open section with not less than 27 gauge galvanized steel channel end stiles welded in place. Provide not less than 0.064-inch galvanized intermediate stiles, cut to door section profile, spaced at not more than 48 inches o.c., and welded in place.

D. Reinforce bottom section with a continuous channel or angle complying with bottom section profile.

E. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth and bolted or welded in place.

F. Provide reinforcement for hardware attachment.

G. Insulation: Insulate inner core of steel sections with manufacturer's standard polyurethane thermal insulation, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84; or with fiberglass thermal insulation. Secure insulation to door section. Enclose insulation completely, with no exposed insulation material evident.

H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.

I. Finish galvanized steel door sections as follows:

1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and surface contaminants.

3. Pretreat zinc-coated steel, after cleaning, with a conversion coating of type suited to organic coating applied over it.

4. Apply manufacturer's standard primer to both door faces after forming, according to coating manufacturer's written instructions for application and minimum dry film thickness. Doors will be finished in field.

J. Glazing: Provide 1/2" insulated double strength glass lights as illustrated on the overhead door elevations in the drawings.

2.03 TRACKS, SUPPORTS, AND ACCESSORIES

A. Track Reinforcement and Supports: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 (ASTM A 36M) and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

B. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

C. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.

1. Provide motor-operated doors with combination bottom weatherseal and photo eyes.
2. In addition, provide continuous flexible seals at door jambs for a weather tight installation.

2.04 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Provide heavy-duty galvanized steel hinges, of not less than 0.0747-inch- (1.9-mm-) thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet (4.87 m) in width, unless otherwise recommended by door manufacturer.

C. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch diameter roller tires for 3-inch track, and as follows:

1. Case-hardened steel tires.

D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

E. Chain Lock Keeper: Suitable for padlock.

F. Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.05 COUNTERBALANCING MECHANISM

A. Torsion Spring: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension torsion springs, fabricated from oil-tempered-steel wire complying with ASTM A 229 (ASTM A 229M), Class II, mounted on a cross-header steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for 50,000 cycles minimum.

- B. Cable Drums: Provide cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide 1 additional midpoint bracket for shafts up to 16 feet (4.87 m) long and 2 additional brackets at one-third points to support shafts more than 16 feet (4.87 m) long, unless closer spacing is recommended by door manufacturer.
- C. Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.
- D. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.06 ELECTRIC DOOR OPERATORS

- A. General: Provide Standard Duty operator equal to Overhead Door RSX® Commercial Operator, $\frac{3}{4}$ hp continuous duty motor, complete with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- B. Comply with NFPA 70.
- C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
- F. Door-Operator Type: Provide unit consisting of electric motor and the following:
 - 1. Trolley or drawbar type, with V-belt primary drive, chain and sprocket secondary drive, and quick disconnect-release for manual operation.
- G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than $\frac{2}{3}$ fps (0.2 m/s) and not more than 1 fps (0.3 m/s), without exceeding nameplate ratings or considering service factor.

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Overhead Door Control Console: Provide a master control console with 4 control stations as indicated on the drawings. Provide momentary-contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop." To operate each door.
- I. Obstruction Detection Device: Provide each motorized door with manufacturer's standard photoelectric sensor to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
- J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
- B. Fasten vertical track assembly to framing at not less than 24 inches (600 mm) o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.03 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.
- B. Adjust belt-driven motors as follows:
1. Use adjustable motor-mounting bases for belt-driven motors.
 2. Align pulleys and install belts.
 3. Tension belt according to manufacturer's written instructions.

3.04 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
5. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 08 36 13

SECTION 08 41 00 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

B. Provide all materials, labor and equipment necessary for the complete installation of aluminum entrances and storefront framing as indicated on the drawings. The work under this section shall include:

1. Exterior entrance doors and frames.
2. Storefront framing with operable project out vents.
3. Aluminum break metal components
4. Weatherstripping, hinges, push/pulls, thresholds, sweeps, deadbolts
5. Perimeter caulking

1.02 RELATED SECTIONS

- A. Section 08 71 00 – Door Hardware
- B. Section 08 71 13 – Door Operators
- C. Section 08 80 00 – Glass and Glazing

1.03 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-02 Shop Drawings: Include elevations, details, hardware mounting heights, anchorages, expansion provisions and glazing details.
2. SD-03 Product Data: Include fabrication methods, finishing, hardware, accessories and installation recommendations.
3. SD-04 Samples: Pairs of each finish, on 12" long section soft extrusions and on 6" square sheets.
4. SD-06 Test Reports: Submit test reports showing compliance with par. 1.04 – Performance Requirements.

1.04 PERFORMANCE REQUIREMENTS

A. Provide certified test results showing systems have been tested by a recognized testing laboratory and comply with characteristics specified.

1. Thermal Movement: Provide for expansion and contraction resulting from an ambient temperature range of 120 deg.F (67 deg.C).
2. Wind Loading: Withstand uniform test pressure of 20 psf inward and outward when tested according to ASTM E 330.
3. Structural (Doors): Resistance to corner racking shall be tested by the dual moment load test as follows:
 - a. Test section shall consist of a standard top door assembly. Side section shall be 24" long and top rail section shall be 12" long.
 - b. Anchor "top rail" positively to test bench so that the end of the top rail protrudes 3" beyond the bench edge.
 - c. Anchor a lever arm positively to "side rail" at a point 19" from inside edge of "top rail". Attach weight support pad at a point 19" from inner edge of "side rail".
 - d. Test section shall withstand a load of 245 pounds on the lever arm before reaching the point of failure, which shall be considered a rotation of the lever arm in excess of 45 degrees.

B. Fixed Framing Transmission Characteristics:

1. Air Infiltration: Not more than 0.06 CFM per sq. ft. when tested according to ASTM E 283 at an inward test pressure differential of 6.24 psf.
2. Water Penetration: No penetration when tested according to ASTM E 331 at an inward test pressure differential of 6.24 lbf. per sq. ft.
3. Condensation Resistance (451-T): Not less than 54 CRF when tested according to AAMA 1502.
4. Thermal Transmittance: Not more than 0.65 BTU/(hr. x sq. ft. x deg. F) at 15 mph wind velocity when tested according to AAMA 1503.

C. Aluminum Entrance Transmission Characteristics:

1. Air Infiltration: Not more than 0.50 CFM for single doors and 1.0 for pairs of doors when tested according to ASTM E 283 at an inward test pressure differential of 1.567 psf.
2. Condensation Resistance (thermally broken door 106): Not less than 48 CRF when tested according to AAMA 1502.

3. Thermal Transmittance: Overall U-value of not more than 0.93 BTU/(hr. x sq. ft. x deg.F) at 15 mph wind velocity when tested according to AAMA 1503.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: 5 years' experience in fabrication.
- B. Installer's Qualifications: 5 years' experience in installation.

1.06 WARRANTY

- A. Manufacturer's Product Warranty: Submit as part of project close-out requirements, two copies of the manufacturer's warranty for entrance system as follows:

1. Warranty Period: Two years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer. **In addition, welded door corner construction shall be supported with a limited lifetime warranty for the life of the door under normal use.**

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Entrance Basis of Design: Except as noted below, product specified is "Standard Wide Stile Entrances" nonthermally broken as manufactured by Tubelite, Inc. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by listed manufacturers are acceptable.

1. Door 106: Thermally broken equal to Tubelite 'Therml=Block Wide Style'

- B. Storefront Basis of Design: Product specified is "T14650 Series", 2 inches by 6-1/2 inches, as manufactured by Tubelite, Inc. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by listed manufacturers are acceptable. The Architect will be the sole judge of the basis of what is equivalent.

- C. Acceptable Alternate Manufacturers

1. Kawneer Co.
2. US Aluminum
3. EFCO

2.02 MATERIALS

A. Aluminum Members

1. Alloy and temper recommended for strength, corrosion resistance, and application of finish; comply with ASTM B 221 for extrusions and ASTM B 209 for sheet or plate.
2. Main framing sections and pressure plates to be of .090 inch minimum wall thickness and snap covers to be of .050 inch minimum thickness.

B. Fasteners: Aluminum, nonmagnetic stainless steel, or other noncorrosive material.

1. Except for application of hardware, do not use exposed fasteners. For hardware, use Phillips flat-head machine screws; match finish of member or hardware being fastened.

C. Weatherstripping: Replaceable compressible neoprene or molded PVC type gaskets or replaceable wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing as suitable for type of door operation.

1. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

D. Thresholds: Extruded mill finished aluminum ADA compliant threshold of width required for frame depth.

E. Glass and Glazing Materials: Comply with requirements of Section 08 80 00 - Glass and Glazing.

F. Shims: Composite shims, tapered and non-tapered as required. Wood shims will not be accepted.

2.03 FABRICATED COMPONENTS

A. Storefront Framing: Thermally broken with interior portion of frame insulated from exterior portion, flush applied glazing stops. Frames for interior glazing need not be thermally broken.

1. Aluminum Storefront Entrance Framing
 - a. Frame face width: 1-3/4" to 2 inches
 - b. Frame Depth: 6-1/2 inches

2. Operable Vents: Provide project-out awning type operable vents consisting of 1" insulated glass silicone glazed to extruded thermally broken aluminum frame on the interior side of the windows. Furnish with screens and wickets, 4-bar hinges, and cam handles.
- B. Stile-and-Rail Type Aluminum Doors: 1-3/4" thick; tubular frame members, with mechanical joints using heavy reinforcing plates and concealed tie-rods or j-bolts.
- C. Prefabrication: Before shipment, complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible. Disassemble only for shipment and installation.
1. Entrance Doors: All entrance doors shall be fabricated by the manufacturer.
 2. Pre-glaze to greatest extent possible.
 3. Do not drill and tap for surface-mounted hardware until installation.
 4. Perform fabrication, including cutting, fitting, forming, drilling and grinding to prevent damage to exposed finish surfaces. For hardware, perform prior to application of finishes.
- D. Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.
- E. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator.
- F. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

2.04 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
1. Finish: AAMA 2605, 70% Fluoropolymer Coating
 - a. Color: Custom color red to match standing seam metal roofing per Section 07 41 00.

2.05 HARDWARE

A. Hinges: Provide pin & barrel type continuous 14-gauge 304 stainless steel hinges with .25 dia. 304 stainless steel pin.

1. Manufacturer: Markar Architectural Products FM-300 Series
2. ANSI/BHMA Standard A 156.26 Grade 1
3. Finish: US 32D

B. Pulls: Provide entrance door manufacturer's standard 1" dia. x 10" (center to center) wire pull handle.

C. Push: 1" dia. bent bar with 90 deg. x 2-1/4" projection at both ends.

D. Threshold: Manufacturer's standard extruded aluminum threshold machined to fit door type, size and type of hinge. Thresholds shall be ADA compliant, 1/2" in height and beveled to the floor on both sides to provide easy access for wheelchairs and strollers.

E. Weatherstripping: Aluminum extrusion with replaceable compressible bulb style insert.

F. Sweep: Aluminum extrusion with replaceable polyurethane smooth insert for mounting to bottom edge of door with concealed fasteners on a mounting strip.

G. Deadbolt: Adams Rite Maximum Security Deadlock MS 1850A, standard long throw bolt of 5-ply laminated steel.

E. Hardware furnished under Section 08 71 00 – Door Hardware but installed under this Section shall include:

1. Door Closers
2. Lock cylinders
3. Exit devices
4. Overhead stops
5. Wall and floor stops.
6. Electric Lockset

2.06 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: As specified in Section 08 80 00.

2.07 PERIMETER CAULKING

A. One-part, low modulus, high performance, neutral curing, nonstaining, construction grade silicone sealant conforming to ASTM C920 Type S, Grade NS, Class 25

1. Uses: NT, G, M, A and O.
2. U.S. Federal spec TT-S-00001543A, Class A.
3. Tremco "Spectrem 1"
4. Color: Provide colored sealant to match aluminum door frame color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Provide proper support and anchor securely in place.

1. Separate aluminum and other corrodible metal surfaces from sources of corrosion at points of contact with other materials.

B. Adjust operating hardware to function properly.

C. Clean system promptly after installation.

3.02 HARDWARE SCHEDULE

HARDWARE GROUP AL-1

EACH SINGLE ALUMINUM DOOR TO HAVE:

DR. 101A, 122A, 106

1 EA CONTINUOUS HINGE MARKAR FM300 32D

1 EA PUSH/PULL

1 EA. THRESHOLD MANUF. STD. (SEE PAR. 2.05 ABOVE)

1 EA WEATHERSTRIP REESE 769 SERIES

1 EA. SWEEP REESE DB591DU

HARDWARE GROUP AL-2

EACH SINGLE ALUMINUM DOOR TO HAVE:

DR. 101B, 122B

1 EA CONTINUOUS HINGE MARKAR FM300 32D

1 EA PUSH / PULL

1 EA. THRESHOLD MANUF. STD. (SEE PAR. 2.05 ABOVE)

1 EA WEATHERSTRIP REESE 769 SERIES

1 EA. SWEEP REESE DB591DU

END OF SECTION 08 41 00

SECTION 08 71 00 – DOOR HARDWARE

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Applicable provisions of Division 1 shall govern all work under this section.
- B. Section includes:
 - 1. Furnish all finish door hardware listed in the hardware schedule specified herein, or required by the drawings.
 - 2. Low energy automatic operators.

1.02 RELATED WORK

- A. Section 06 20 00 - Finish Carpentry
- B. Section 08 11 13 - Steel Doors and Frames
- C. Section 08 14 16 - Wood Doors: Any intumescent material that may be required to comply with positive pressure fire door testing to be supplied by the wood door supplier.
- D. Section 08 41 00 - Aluminum Entrances: Continuous hinges, weatherstrip, thresholds, and sweeps to be supplied by aluminum door supplier, unless otherwise stated.

1.03 REFERENCES

- A. A.D.A.-Americans with Disabilities Act.
- B. ANSI A117.1 Specification for making facilities accessible to physically handicapped people.
- C. NFPA 80 Standards for Fire Doors and Windows
- D. NFPA 101 Life Safety Code
- E. U.L. Building Material Directory
- F. D.H.I. Recommended Locations for Architectural Hardware
- G. Applicable State and Building Codes, including IBC 2000

1.04 SUBMITTALS

- A. Submit the following according to Section 01 33 00 – Submittal Procedures:

B. SD-02 - Schedules: Submit detailed hardware schedule, vertical format. Prepare under the supervision of an AHC, registered Architectural Hardware Consultant, and under provisions of Division 1.

1. Itemize hardware in the sequence and format established by this specification.
2. List and describe each opening separately. Include all doors with identical hardware, except hand, in a single heading. Include door number, room designations, degree of swing except hand, in a single heading.
3. List related details. Include dimensions, door and frame material and other considerations affecting hardware.
4. List all hardware items to be supplied. Include manufacturer's name, catalog number, size, finish, attachments and related details where applicable.
5. Keying Schedule: After receipt of approved hardware schedule, submit a copy of keying schedule as a result of an on-site keying meeting between the Owner, Architect and the Hardware Supplier.

C. SD-04- Samples: Submit samples of finish hardware items for approval. Properly identify each sample as to make and number, and finish.

D. SD-08 -Manufacturer's Instructions:

1. Field Templates: Furnish a copy of approved hardware schedule, along with applicable templates for factory-prepared hardware to each door and frame fabricator.
2. Electrical Hardware: Submit electrical specifications and applicable information to the electrical contractor after receipt of the approved hardware schedule.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Except where specified in the hardware schedule, furnish products of only one manufacturer for each type of hardware.
2. Supplier: A company experienced in the builders hardware industry for a minimum of two years, and can call upon an AHC for consultation during the full extent of project.

B. Regulatory Requirements

1. Furnish UL or Warnock Hersey listed hardware for all fire labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
2. Furnish hardware that conforms to all applicable State and local building codes.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle according to Division 1. Mark each original container with a door number that corresponds to the approved hardware schedule for the installation location.
- B. Receive, inventory and store hardware in a secure and dry environment. Protect against loss and damage.
- C. Report any shortages to the hardware supplier no later than 48 hours after receipt of delivery to the job site.
- D. Stockpile items sufficiently in advance to ensure their availability.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Products	Specified	Acceptable
Hinges	McKinney	Stanley, Hagar, Ives
Closers	LCN	Sargent, Norton
Exit Devices	Von Duprin	Precision, Sargent
Flush Bolts	Rockwood	DCI, Trimco, Ives
Locks & Latches	Schlage	Sargent, Best
Electric Cylindrical Locksets	Schlage	Sargent, Best
Electric Locks w/ Keypad	Schlage AD-Series	No substitutions
Push/Pull	Rockwood	Trimco, Hager, Ives
Protective Plates	Rockwood	Burns, Hager, Ives
Overhead Stops, Holders	Glynn Johnson	ABH, Sargent
Wall & Floor Stops	Rockwood	Trimco, DCI, Ives
Threshold, Sweeps &		
Weatherstrip	Reese	Pemko, National Guard
Low Energy Automatic Operators	LCN	Norton

2.02 HINGES

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>Ives</u>	<u>Stanley</u>	<u>McKinney</u>	<u>Hager</u>
Std. Wt. Plain Bearing Steel	5PB1	F179	T2714	1279
Std. Wt. Ball Bearing Steel	5BB1	FBB179	TA2714	BB1279
Std. Wt. Ball Bearing –nonferrous	5BB1	FBB191	T4B3786	BB1168
Hvy. Wt. Ball Bearing Steel	5BB1HW	FBB168	T4B3786	BB1168
Hvy. Wt. Ball Bearing –nonferrous	5BB1HW	FBB179	T4B3386	BB1199

B. Hinges supplied must be tested and comply with ANSI/BHMA standard for consistency, wear and corrosion resistance.

C. Quantity: Furnish hinges for each door leaf as follows, unless otherwise noted in groups.

1. Doors up to and including 90” high-3 Hinges
2. Doors over 90” high through 120” -4 hinges

D. Type: Furnish as indicated in hardware groups.

2.03 FLUSH BOLTS

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>Rockwood</u>	<u>Ives</u>	<u>Trimco</u>	<u>DCI</u>
Manual-Metal door	555	FB458	3917	780F
Manual-Wood door	557	FB358	3913	790F
Automatic Metal door	1842	FB31P	3810	842
Automatic Wood door	1962			962
Self- latching metal door	1845	FB51P	3820	845
Self- latching wood door	1945	FB61P	3825	945
Dust proof strike	570	DP2	3911	82

B. Furnish a dustproof strike for all bottom bolts

2.04 LOCKS AND LATCHES

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>Best</u>	<u>Schlage</u>	<u>Sargent</u>
Heavy-Duty Mortise	45H	L9000	8200
Heavy-Duty Grade 1 Cyl.	93K	ND Series	10 Line

B. Furnish lever designs as indicated in groups.

C. Furnish lock types and functions as specified in the hardware schedule and as follows:

1. Provide 2-3/4" backset
2. Provide 2-3/4" x 1-1/8" T strike with a dust box for use in wood doors or frame
3. Provide 4-7/8" x 1-1/4" ANSI strike for installation in a hollow metal door or Frame.
4. Locksets to conform to ANSI A156.2, Series 4000, Grade 1 and be UL listed
5. Locksets and cores to be of same manufacturer to maintain complete lockset warranty

2.05 EXIT DEVICES

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>Von Duprin</u>	<u>Precision</u>	<u>Sargent</u>
Wide Stile Rim	98	2100	8800
Wide Stile Vert. Rod	9827	2200	8700
Wide Stile Conc Vertical Rod	9875	2800	8600
Wide Stile Mortise	9875	2300	8900
Narrow Stile Rim	35	2400	8500
Narrow Stile Conc Vert. Rod	3547	2600	8400

B. Furnish exit device types and functions as specified in the Hardware Schedule.

C. Lever handles supplied with exit devices shall match the design specified for locks/latches.

2.06 PULLS, PUSH BARS, PUSH/PULL PLATES

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>Rockwood</u>	<u>Trimco</u>	<u>Burns</u>	<u>Ives</u>

B. Supply product as listed in groups and equal to acceptable manufacturers

2.07 DOOR CLOSERS

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>Norton</u>	<u>LCN</u>	<u>Sargent</u>
Heavy Duty Reg. Arm	7500	4041	350
Heavy Duty Parallel Arm	PR7500	4041 EDA	350 PED
Heavy Duty Stop Arm	CLP7500	4041 Cush	350 PS

2.08 LOW ENERGY AUTOMATIC OPERATORS

A. Acceptable manufacturers and respective catalog numbers (shall be included in the hardware package).

<u>Description</u>	<u>LCN</u>	<u>Norton</u>
Operator – Push Side	4640	6960
Operator – Pull Side	4630	6910
Hardwired Wall Switch	956	685
Wireless Wall Switch	957	574
Wireless Receiver	931	RFI

B. Provide arms, mounting plates, sizes, stops, and any components that may be necessary to interface with electrified hardware that are required to complete and proper operation of the openings affected. Complete installation must meet or exceed requirements of ANSI A159.19.

C. Provide actuators as detailed in hardware groups.

D. Conduit, electrical back boxes, wiring, and 120 VAC input power by Division 26 – Electrical.

2.09 PROTECTIVE PLATES

A. Acceptable manufacturers: Rockwood, Trimco, Burns, Hager

B. All kickplate heights shall be as listed in groups and 2” less door width single doors and 1” less for pairs.

C. Thickness shall be .050” (16 gauge).

2.10 OVERHEAD STOP/HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>ABH</u>	<u>Sargent</u>	<u>Glynn Johnson</u>
Heavy Duty Surface	9000	500	90
Heavy Duty Concealed	1000	600	100
Standard Duty Surface	4400	1540	450
Standard Duty Concealed	4000	1530	410

B. Furnish an overhead stop if a door opens against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in the hardware groups.

2.11 WALL STOPS

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>Rockwood</u>	<u>Hager</u>	<u>Ives</u>
Wrought Convex Wall	407	232W	WS406
Wrought Concave w/Toggle	409	237W	WS407

B. When "wall stop" is called for in hardware group, provide 407 or 409. When overhead stops are required, they will be specified by product number in group.

C. Wall stops shall not be mounted to casework, cabinet work, sidelights or equipment.

D. Where wall stops are specified, but not applicable, supply an overhead stop as specified in Paragraph 2.10

2.12 THRESHOLDS, SWEEPS, WEATHERSTRIP, DRIP CAPS, GASKETS

A. Acceptable manufacturers and respective catalog numbers:

<u>Description</u>	<u>Reese</u>	<u>Pemko</u>	<u>Nat'l Guard</u>
Threshold	S205	171A	425A
Sweep	323	315N	200N
Sweep	967	18133CP	OV633
Weatherstrip	970	45100CP	603
Weatherstrip	DS78	315CR	130N
Gasket	797B	588	1010

B. Where specified in groups, furnish the above products unless otherwise detailed.

2.13 DOOR HARDWARE FINISHES

A. Unless indicated otherwise in the groups, provide finishes as follows:

1.	Hinges exterior	US32D
2.	Hinges interior	US26D
3.	Flush Bolts	US26D
4.	Exit Devices	US32D
5.	Locks and Latches	US26D
6.	Pulls, Pushbars, Push/Pull	US32D
7.	Door Closers	Painted Aluminum
8.	Protective Plates	US32D
9.	Overhead stops	Painted Aluminum
10.	Wall Stops	US32D
11.	Gasket	Black
12.	Threshold	Mill Aluminum
13.	Weatherstrip/Sweeps	Clear Anodized Aluminum
14.	Automatic Door Operators	Painted Aluminum

2.14 KEYING

A. Cylinders shall be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards:

1. DHI Handbook "Keying systems and nomenclature" (1989)

C. Cylinders: Shall be interchangeable cores.

D. Keying:

1. Contact Owner to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock.

E. Key into Owner's existing keying system if applicable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors, frames and related items for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected.

3.02 INSTALLATION

- A. Install each hardware item in strict compliance with the manufacturers printed instructions and recommendations, using only fasteners as supplied by, or called for by the manufacturer.
- B. Set units level, plumb and true to the line and location. Prepare and reinforce the attachment substrate as necessary for proper installation and operation.
- C. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work. Drill on countersink units which are not factory prepared for anchorage fasteners.
- D. If manufacturers' instructions do not call out a mounting location, refer to the Door and Hardware Institute's publication Recommended Locations for Architectural Hardware.
- E. Delivery to the Owner, one (1) complete set of installation and adjustment instructions, as well as all tools that were furnished with the hardware.

3.03 ADJUSTMENT AND CLEANING

- A. At final completion, adjust and check each operating item of hardware at each door to ensure proper operation and function of every unit. Lubricate any moving parts that do not operate freely, smoothly, and quietly using only lubricant as recommended by the manufacturer of the hardware item. Replace units that cannot be adjusted or lubricated to operate properly.
- B. Instruct the Owner's personnel in the proper adjustments of the hardware as needed.
- C. Clean and restore hardware to the original finish.

3.04 HARDWARE SCHEDULE

HARDWARE GROUP 1

EACH SINGLE ALUMINUM DOOR TO HAVE:

DR. 101A

1 EA	EXIT DEVICE	98NLx990NL-R	VON DUPRIN
1 EA	RIM CYLINDER	20-057	SCHLAGE
1 EA	DOOR OPERATOR	4630	LCN
2 EA	ACTUATORS	956	LCN

CONTINUOUS HINGE, WEATHERSTRIP, SWEEP, AND THRESHOLD BY ALUMINUM ENTRANCE SUPPLIER.

HARDWARE GROUP 2

EACH SINGLE ALUMINUM DOOR TO HAVE:

DR. 122A

1 EA	EXIT DEVICE	98EO	VON DUPRIN
1 EA	ELECTRIC LOCKSET	AD-200-993R-70-MTK-SPA-PD	SCHLAGE
1 EA	CLOSER (DR. 122A)	4040 CUSH	LCN

CONTINUOUS HINGE, WEATHERSTRIP, SWEEP, AND THRESHOLD BY ALUMINUM ENTRANCE SUPPLIER.

HARDWARE GROUP 3

EACH SINGLE ALUMINUM DOOR TO HAVE:

DR. 101B, 122B

1 EA	EXIT DEVICE	98DT x 990DT	VON DUPRIN
1 EA	DOOR OPERATOR	4630 (DR 101B)	LCN
2 EA	ACTUATORS	956	LCN
1 EA	DOOR CLOSER (DR 122B)	4040 RW/PA	LCN
1 EA	WALL STOP	409	ROCKWOOD

CONTINUOUS HINGE, WEATHERSTRIP, SWEEP, AND THRESHOLD BY ALUMINUM ENTRANCE SUPPLIER

HARDWARE GROUP 4

EACH SINGLE DOOR TO HAVE:

DR. 101C

3 EA	BUTTS	TA2714NRP- 4.5 X 4.5	MCKINNEY
1 EA	LOCKSET	ND70 x SPA	SCHLAGE
1 EA	DOOR CLOSER	4040 RW/PA	LCN
1 EA	WALL STOP	409	ROCKWOOD
1 EA	KICK PLATE	16"x 2" LDW 320	ROCKWOOD
1 EA	SMOKE SEAL	797B	REESE

HARDWARE GROUP 5

EACH SINGLE DOOR TO HAVE:

DR. 103, 104,108,110

3 EA	BUTTS	TA2714- 4.5 X 4.5	MCKINNEY
1 EA	PRIVACY SET	ND40S x SPA	SCHLAGE
1 EA	CLOSER	4040 REG x HO	LCN
1 EA	WALL STOP	409	ROCKWOOD
1 EA	FLOOR STOP@104	442	ROCKWOOD

HARDWARE GROUP 6

EACH SINGLE DOOR TO HAVE:

DR. 111, 116

3 EA BUTTS	TA2714NRP- 4.5 X 4.5	MCKINNEY
1 EA LOCKSET	ND 80 x SPA	SCHLAGE
1 EA O.H. STOP	450S	GLYNN JOHNSON

HARDWARE GROUP 7

EACH SINGLE DOOR TO HAVE:

DR. 114, 115, 117A, 117B, 123C

3 EA BUTTS	TA2714NRP- 4.5 X 4.5	MCKINNEY
1 EA LOCKSET	ND70 x SPA	SCHLAGE
1 EA FLOOR STOP @117A	442	ROCKWOOD
1 EA WALL STOP	409	ROCKWOOD

HARDWARE GROUP 8

EACH SINGLE DOOR TO HAVE:

DR. 107

3 EA BUTTS	TA2714NRP- 4.5 X 4.5	MCKINNEY
1 EA LOCKSET	ND70 x SPA	SCHLAGE
1 EA WALL STOP	409	ROCKWOOD

HARDWARE GROUP 9

EACH SINGLE DOOR TO HAVE:

DR. 124A, 124D

3 EA BUTTS	TA2314NPD 4.5 X 4.5	MCKINNEY
1 EA ELECTRIC LOCKSET	AD-200-CY-70-MTK-SPA	SCHLAGE
1 EA CLOSER	4040 CUSH	LCN
1 EA KICKPLATE	16"x 2" LDW	ROCKWOOD
1 EA WEATHERSTRIP	815A	REESE
1 EA SWEEP	323A	REESE
1 EA THRESHOLD	S40SA	REESE
1 EA LATCH PROTECTOR	320CL	ROCKWOOD

HARDWARE GROUP 10

EACH SINGLE DOOR TO HAVE:

DR. 124B, 124C

3 EA BUTTS	TA2714NRP- 4.5"x4.5"	MCKINNEY
1 EA LOCKSET	ND80 x SPA	SCHLAGE
1 EA CLOSER	4040 CUSH	LCN
1 EA KICKPLATE	16' X 2' LDW	ROCKWOOD
1 EA WEATHERSTRIP	815A	REESE
1 EA SWEEP	323A	REESE
1 EA THRESHOLD	S40SA	REESE
1 EA LATCH PROTECTOR	320CL	ROCKWOOD

HARDWARE GROUP 11

EACH SINGLE DOOR TO HAVE;

DR. 105A

3 EA	BUTTS	TA2714NRP- 4.5 x 4.5	MCKINNEY
1 EA	ELECTRIC LOCKSET	ND96EL	SCHLAGE
1 EA	POWER TRANSFER	EPT2	VON DUPRIN
1 EA.	POWER SUPPLY	505-ULAC-KLC	SCHLAGE
3 EA	PUSH BUTTON SWITCH	621AL	SCHLAGE
1 EA	DOOR CLOSER	4040 HEDA	LCN
1 EA	KICK PLATE	16"x 2" LDW 320	ROCKWOOD
1 EA.	FLOOR STOP	442	ROCKWOOD

HARDWARE GROUP 12

EACH SINGLE ALUMINUM DOORS TO HAVE:

DR. 105B

2 EA	SPRING HINGES	1552- 4.5"x 4.5"	MCKINNEY
1 EA	EDGE GUARD	EG341 (TOP DOOR EDGE)	MCKINNEY
1 EA	FLOOR STOP	442	ROCKWOOD

HARDWARE GROUP 13

EACH SINGLE ALUMINUM DOOR TO HAVE:

DR. 106

1 EA	ELECTRIC LOCKSET	AD-200-993R-70-MTK-SPA	SCHLAGE
1 EA	EXIT DEVICE	98EO	VON DUPRIN
1 EA	DOOR CLOSER	4040 EDA	LCN

CONTINUOUS HINGE, WEATHERSTRIP, SWEEP, AND THRESHOLD BY ALUMINUM SUPPLIER

HARDWARE GROUP 14

EACH SINGLE DOOR TO HAVE:

DR. 123A

3 EA	BUTTS	TA2714NRP- 4.5 X 4.5	MCKINNEY
1 EA	ELECTRIC LOCKSET	AD-200-CY-70-MTK-SPA	SCHLAGE
1 EA	DOOR CLOSER	4040 CUSH	LCN
1 EA	KICK PLATE	16" x 2" LDW 320	ROCKWOOD
1 EA	SMOKE SEAL	797B	REESE

HARDWARE GROUP 15

EACH SINGLE DOOR TO HAVE:

DR. 113, 118

3 EA	BUTTS	TA2714NRP- 4.5 X 4.5	MCKINNEY
1 EA	LOCKSET	ND 80 x SPA	SCHLAGE
1 EA	DOOR CLOSER	4040 CUSH	LCN
1 EA	KICK PLATE	16" x 2" LDW 320	ROCKWOOD
1 EA	SMOKE SEAL	797B	REESE

HARDWARE GROUP 16

EACH SINGLE DOOR TO HAVE:

DR. 112A

3 EA	BUTTS	TA2714NRP- 4.5 X 4.5	MCKINNEY
1 EA	LOCKSET	ND 80 x SPA	SCHLAGE
1 EA	DOOR CLOSER	4040 RW/PA	LCN
1 EA	O.H. STOP	450S	GLYNN JOHNSON
1 EA	KICK PLATE	16" x 2" LDW 320	ROCKWOOD
1 EA	SMOKE SEAL	797B	REESE

HARDWARE GROUP 17

EACH SINGLE DOOR TO HAVE:

DR. 109A, 109B

3 EA	BUTTS	TA2714NRP- 4.5 x 4.5	MCKINNEY
1 EA	LOCKSET	ND 70 X SPA	SCHLAGE
1 EA	DOOR CLOSER	4040 CUSH	LCN

HARDWARE GROUP 18

EACH SINGLE DOOR TO HAVE:

DR. 119

3 EA.	BUTTS	TA2714NRP- 4.5 x 4.5	MCKINNEY
1 EA	LOCKSET	ND 70 X SPA	SCHLAGE
1 EA	CLOSER	4040 REG	LCN
1 EA	O.H. STOP	450S	GLYNN JOHNSON
1 EA	SMOKE SEAL	797B	REESE

HARDWARE GROUP 19

EACH SINGLE DOOR TO HAVE:

DR. 123B

3 EA	BUTTS	TA2714-4.5 x 4.5	MCKINNEY
1 EA	PASSAGE LATCHSET	ND 10S x SPA	SCHLAGE
1 EA	WALL STOP	409	ROCKWOOD

HARDWARE GROUP 20

EACH SINGLE DOOR TO HAVE:

DR. 001A

3 EA	BUTTS	TA2314NRP- 4.5 x 4.5	MCKINNEY
1 EA	LOCKSET	ND 80 x SPA	SCHLAGE
1 EA	WALL STOP	409	ROCKWOOD
1 EA	WEATHERSTRIP	815A	REESE
1 EA	SWEEP	323A	REESE
1 EA	THRESHOLD	S40SA	REESE
1 EA	LATCH PROTECTOR	320CL	ROCKWOOD

HARDWARE GROUP 21

EACH SINGLE DOOR TO HAVE:

DR. 112B

3 EA	BUTTS	TA2714NRP-4.5 x 4.5	MCKINNEY
1 EA	PASSAGE LATCHSET	ND 80 x SPA	SCHLAGE
1 EA	WALL STOP	409	ROCKWOOD

END OF SECTION 08 71 00

SECTION 08 80 00 – GLASS AND GLAZING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Glass and glazing for Sections referencing this Section for products and installation.

1.02 RELATED SECTIONS

- A. Section 08 11 13 - Standard Steel Doors And Frames
- B. Section 08 14 16 – Flush Wood Doors
- C. Section 08 41 00 – Aluminum Entrances

1.03 REFERENCES

- A. Glazing Standard: Comply with GANA "Glazing Manual" and FGMA "Sealant Manual".
- B. Safety Glazing Standard: Comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

1.04 SUBMITTALS

- A. SD-04 Samples of each glass indicated, except for clear single pane units; and of each type of sealant or gasket exposed to view.
- B. SD-07 Certificates of compliance from glass and glazing materials manufacturers.

PART 2 - PRODUCTS

2.01 GLASS

- A. Viracon.
- B. Pilkington Libbey-Owens-Ford.
- C. PPG Industries Inc.
- D. Oldcastle Glass

2.02 FLAT GLASS MATERIALS

- A. Primary Glass Products: Comply with ASTM C 1036 for the following:
 - 1. Clear Float Glass: Type I, Class 1, Quality q3.
- B. Uncoated Heat-Treated Glass Products: Comply with ASTM C 1048 and with manufacturing process indicated for the following:
 - 1. Clear Tempered Float Glass: Kind FT, Condition A, Type I, Class 1, Quality q3.

2.03 SEALED INSULATING GLASS UNITS

- A. General: Comply with requirements of ASTM E 774 for Class A units and the following:
 - 1. Performance characteristics indicated are those of units and are based on manufacturer's published test data for units with 1/4" thick panes and 1/2" thick air space. U-values are indicated in Btu per hr. per sq. ft. per deg. F difference.
 - 2. For properties of individual glass panes making up units, refer to product requirements specified elsewhere in this section applicable to types, classes, kinds and conditions of glass products indicated.
 - 3. Provide heat-treated, coated float glass of kind indicated or, if not otherwise indicated, Kind HS (heat strengthened) where recommended by manufacturer to comply with system performance requirements specified and Kind FT (fully tempered) where safety glass is designated or required.
 - 4. Outboard Lite: 1/4" clear tempered float glass
 - 5. Inboard Lite: 1/4" clear tempered float glass with Low 'E' coating on #2 surface.

6. Sealing System: Manufacturer's standard.
7. Spacer Material: Manufacturer's standard metal.

2.04 FIRE RATED GLAZING MATERIALS (IMPACT SAFETY RATED)

A. Manufacturer: SGG Swissflam N2 / SGG Contraflam N2 as manufactured by Vetrotech Saint-Gobain NA, Auburn, WA Telephone 888-803-9533

B. Properties:

1. Thickness: Varies with rating and application (range from 5/8" to 2 1/8")
2. Weight: Varies with thickness (approx. range 8 to 25 lbs. / sq. ft.)
3. Approx. visible light transmission: Varies with thickness. (approx. range 85 to 70 percent)
4. Fire Rating: 45 minutes – 2 hours
5. Impact Safety Rating: ANSI Z97.1 and CPSC 16CFR1202 (Cat I & II)
6. STC Rating: Up to 44Db

C. Labeling: Permanently label each lite of SGG Swissflam N2 / SGG Contraflam N2 with laboratory logo (WHI and/or UL), product and manufacturer's name, rating, and safety specifications.

D. Fire Rating: Fire-rating listed and tested by Intertek Testing (WHI) for fire rating scheduled at opening locations in drawings, when tested according to (ASTM E-119)(ASTM E-152) (ASTM E-163) (UBC Standards 7-1-97, 7-2 and 7-4) (NFPA 251) (NFPA 252) (NFPA 257) (UL 9) (UL10B & 10C) (UL 263)

2.05 GLAZING ACCESSORIES

A. Comply with sealant and glass manufacturers for selection of glass sealants which suit project application and installation conditions and which are compatible with surfaces contacted. Provide color of exposed sealants indicated or as selected by Architect.

1. 1-Part Non-Acid-Curing Silicone Glazing Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to uses indicated, O; and as follows:

- a. Medium-Modulus: With additional capability to withstand an increase or decrease in joint width of 50 percent of joint width and a tensile strength of 75 psi or less per ASTM D 412 at 100 percent elongation after 14 days at 77 deg. F (25 deg. C).

B. Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

C. Blocks and Spacers: Neoprene, EPDM or silicone as required for compatibility with glazing sealants; of 80 to 90 Shore A hardness for setting blocks and, for spacers and edge blocks, of hardness recommended by glass and sealant manufacturer for application indicated.

2.06 GLAZING SCHEDULE

Glass Type **GL-1** – Heat Treated Float Glass

- A. Interior glazing at non-rated doors and sidelights.
 - 1. ASTM C1048, Condition A (uncoated surfaces).
 - 2. Type 1 (transparent glass, flat).
 - 3. Class I (clear)
 - 4. Quality q3 (glazing select)
 - 5. Fully tempered
 - 6. 1/4"-thick, unless otherwise indicated.

Glass Type **GL-2** – Fire-Rated Glass

- A. Glazing located in rated partitions, doors and sidelights.
 - 1. Provide "Firelite Plus" as manufactured by Nippon Electric Glass Co. The rating of the material shall match the rating of the door.

Glass Type **GL-3** – Heat Treated Sealed Insulating Glass Units

- A. Glazing located in exterior doors and sidelights.
- B. Sealed Insulating Glass Units: Preassembled units consisting of organically sealed lights of glass separated by dehydrated air space complying with ASTM E 774 and with other requirements as indicated on the drawings.
 - 1. Glass Type GL-3 – Low E: Provide 1 inch insulating glass units (1/4" INE – 169 Neutral Low-Emmissivity (2) on clear on outboard glass, 1/2" airspace, 1/4" clear on inboard glass) fully-tempered, as produced by Guardian, Cardinal, PPG or approved equal.

Glass Type **GL-4** – Sealed Insulating Glass Units

- A. Glazing located in exterior manufactured windows.
- B. Sealed Insulating Glass Units: Preassembled units consisting of organically sealed lights of glass separated by dehydrated air spaces complying with ASTM E 774 and with other requirements as indicated on the drawings.

- 1. Glass Type GL-4 – Low E: Provide 1 inch insulating glass units (1/4-inch INE-169 Neutral Low-Emissivity (2) on clear on outboard glass, 1/2” airspace, 1/4” clear on inboard glass), as produced by Guardian, Cardinal, PPG, or approved equal.

Glass Type **GL-5** – Laminated Glass

- A. Laminated Glass: ASTM C 1172, as indicated at interior non-rated doors and sidelights.
- B. Interlayers: Type as indicated below and of thickness indicated or required to comply with performance requirements and with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating to glass and installation:
 - 1. Polyvinyl butyral sheet, clear.
- C. Fabrication: Laminate glass with interlayers to produce laminated lights free of foreign substances, air, and glass pockets.
- D. Laminated-Glass Units LG-1: LHS (two or more lights of heat-strengthened float glass) consisting of two lights.

PART 3 - GLASS INSTALLATION (GLAZING)

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Glazing Contractor shall confirm all field measurements of openings scheduled to receive glass prior to fabrication.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer and sealer.

3.03 GLAZING

- A. General: Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and gaskets, to achieve airtight and watertight performance, and to minimize breakage.
- B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- C. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- D. Protect glass from contact with contaminating substances resulting from construction operations; remove any such substances by method approved by glass manufacturer.

3.04 CLEANING

- A. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08 80 00

SECTION 08 84 00 – INSULATED TRANSLUCENT PANELS

PART 1 – GENERAL

1.01 SUMMARY

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section includes labor, materials, and equipment for the installation of factory glazed, translucent panel, including accessories, weep system and trim according to these specifications and the drawings. Design, furnishing and installation of all attachments of panels to structure shall be the responsibility of the panel supplier.

1.02 RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry: Treated wood blocking
- B. Section 07 60 00 – Flashing & Sheet Metal: Sill flashing

C. Section 07 92 00 – Joint Sealants

1.03 SUBMITTALS

A. SD-02 Submit shop drawings and color samples according to Section 01 33 00 – Submittal Procedures.

B. SD-06 Test reports to be furnished by sandwich panel system manufacturer according to Section 01 33 00 – Submittal Procedures. The manufacturer shall submit certified test reports made by an independent testing organization for each type and class of panel system. Reports shall verify that the material will meet all performance requirements of this specification. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project. Test reports required are:

1. Flame Spread and Smoke Developed (ASTM E-84 by UL 723)
2. Burn Extent (ASTM D-635)
3. Color Difference (ASTM D-2244)
4. Impact Strength (Free Falling Ball Method)
5. Tensile Bond Strength (ASTM C-297) after aging by ASTM D-1037
6. Shear Bond Strength (ASTM D-1002) after five (5) separate conditions
7. Beam Bending Strength (ASTM E-72)
8. Insulation “U” Factor (by NFRC-100: ASTM C-236, E-1423 and C-1199)
9. NFRC Certification
10. Condensation Resistance Factor (AAMA 1503.1)

1.04 QUALITY ASSURANCE

A. Manufacturer's and Erector's Qualifications

1. Sandwich panel system must be listed by a recognized building code authority including the International Code Council, which requires quality control inspections and fire, structural and water infiltration testing by an approved agency for sandwich panel systems.
2. Quality control inspections and required testing conducted at least once each year shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with “Acceptance Criteria for Sandwich Panels” as regulated by the ICC-ES or equivalent.
3. Materials and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of these materials being satisfactorily used on at least six projects of similar size, scope and location within such a period. At least three of the projects shall have been in successful use for ten years or longer.

4. Erection shall be by installer, which has been in the business of erecting specified materials for at least five consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

B. Performance Requirements: The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1.05 PRODUCT HANDLING

A. Store translucent panels on the long edge, several inches above the ground, blocked and under cover to prevent warping according to manufacturer's storage and handling instructions.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. For basis of design, the plans are based on Kalwall Corporation.

B. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications.

1. Major Industries

2.02 MATERIALS – TRANSLUCENT PANELS

A. Translucent panels shall consist of 2-3/4" thick flat factory prefabricated sandwich panels with translucent faces manufactured from glass fiber reinforced thermoset resins especially for architectural use. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.

1. Exterior Face Sheet: 'Crystal' with manufacturer's standard glass erosion barrier.

2. Interior Face Sheet: 'Crystal', interior sheet per ASTM E84 by UL 723.

B. Flammability – The interior face sheet shall be U.L. listed and have a flame spread rating no greater than 50 and smoke developed no greater than 250 when tested according to UL 723. Burn extent by ASTM D-635 shall be no greater than 1". Faces shall not deform, deflect or drip when subjected to fire or flame or delaminate when exposed to 300°F for 25 minutes.

C. Weatherability

1. The full thickness of the exterior face shall not change color more than 3.0 Hunter or CIE Units DELTA E by ASTM D-2244 after five years outdoor South Florida weathering at 5 degrees facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure maximum, long term color stability. Color stability shall be unaffected by abrasion or scratching.

2. The exterior face shall have a permanent glass veil erosion barrier embedded integrally to provide maximum long-term resistance to reinforcing fiber exposure. Sacrificial plastic surface films or coatings such as Tedlar are not acceptable.

D. Appearance - Exterior face sheets shall be smooth, .070" thick and crystal in color. Interior face sheets shall be .045" thick and white in color. Faces shall not vary more than $\pm 10\%$ in thickness and be uniform in color.

E. Strength - The exterior face sheet shall be uniform in strength and repel an impact equal to 60 ft. lbs. without fracture or tear when impacted by a 3-1/2" diameter, 6.37 lb. free falling ball, and be resistant to penetration by pencil point.

2.03 GRID CORE

A. Panels shall incorporate a thermally broken I-beam grid core with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16". The I-beam grid shall be machined to tolerances of not greater than $\pm .002$ ". Thermal break shall be minimum 1". The entire grid core, not just the perimeter grid, shall be thermally broken with a CRF of 80 measured on the grid itself, not the center of grid. No exceptions.

B. Thermally Broken panels shall withstand 1200°F fire for minimum one (1) hour without collapse or exterior flaming.

2.04 ADHESIVE

A. The laminate adhesive shall be heat and pressure resin type engineered for structural sandwich panel use, with minimum 25 years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".

B. Minimum tensile strength shall be 750 PSI by ASTM C-297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D-1037.

C. Minimum shear strength by ASTM D-1002 after exposure to five separate conditions:

1. 50% Relative Humidity at 73° F: 540 PSI
2. 182° F: 100 PSI
3. Accelerated Aging by ASTM D-1037 at room temperature: 800 PSI
4. Accelerated Aging by ASTM D-1037 at 182° F: 250 PSI
5. 500 Hour Oxygen Bomb by ASTM D-572: 1400 PSI

2.05 PANEL CONSTRUCTION

- A. Panels shall have a thickness of 2-3/4" with a "U" factor by NFRC certified laboratory of .10, light transmission of 8% and shading coefficient of .07. Complete system shall be NFRC certified.
- B. Translucent panels shall be a true sandwich panel of flat fiberglass sheets bonded to a grid core of mechanically interlocking thermally broken I-beams. Panels shall be laminated under a controlled process of heat and pressure, and deflect no more than 1.9" at 30 psf in 10' by ASTM E-72.
- C. Grid pattern shall be nominal 12" x 24" shoji.
- D. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
- E. Panel Weeps: Weep holes on down slope side of installed panels to permit condensation to leave panel interior.

2.06 BATTENS AND PERIMETER CLOSURE SYSTEM

- A. Closure system shall be extruded 6063-T6 and 6063-T5 thermally broken aluminum screw clamp-tite.
- B. All battens and perimeter closures to be supplied with 300 series stainless steel screws (excluding final fasteners to the building).
- C. All exposed aluminum to be architectural corrosion resistant finish which meets the performance requirements of AAMA 2604, color to be selected from manufactures standards.
- D. Maintain continuous air barrier and vapor retarder throughout assembly in line with inside face of sandwich panel.
- E. Provide flashing tabs at every batten and perimeter joint to prevent air infiltration.

2.07 FLEXIBLE SEALING TAPE

A. Vapor retarding sealing tape shall be manufacturer's standard to prevent air infiltration into panel cells.

PART 3 - EXECUTION

3.01 PREPARATION

A. The general contractor shall prepare openings including isolating dissimilar materials from aluminum system, which may cause damage by electrolysis and shall provide temporary enclosures if required.

3.02 ERECTION

A. The erector shall erect translucent panel system in strict accordance with approved shop drawings as supplied by manufacturer. Fastening and sealing shall be in strict accordance with manufacturer's shop drawings and installation instructions. All surfaces shall be cleaned before sealants are applied.

B. After other trades have completed work on adjacent material, carefully inspect translucent panel installation and make adjustments necessary to ensure proper installation and weather-tight conditions.

C. All staging, lifts and hoists required for the complete insulated panel installation, including staging, etc., necessary for field measuring, shall be provided by, set up and maintained by the general contractor.

END OF SECTION 08 84 00

END OF DIVISION 08 – OPENINGS

DIVISION 09 – FINISHES

SECTION 09 22 16 – NON-LOAD BEARING METAL WALL FRAMING

PART 1 – GENERAL

1.01 SCOPE OF WORK

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

B. Work Included: Provide metal studs, furring channels, and accessories as indicated on the drawings, as specified herein.

1.02 RELATED SECTIONS

A. Section 07 46 00 – Metal Soffit Panels

B. Section 09 29 00 – Gypsum Board

1.03 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-03 Product Data: Manufacturer's product information

1.04 REFERENCES

A. ASTM C 645 – Standard Specification for Nonstructural Steel Framing Members, 2000.

B. ASTM C 754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

C. ASTM C 1513 – Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

D. AISI Specification for the Design of Cold-Formed Structural Members.

E. AISI – Standard for Cold-Formed Steel Framing General Provisions

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Dietrich Metal Framing, Miami, FL

- B. Clark Steel Framing Systems, Middletown, Ohio
- C. Nuconsteel (A Nucor Company), Denton, TX

2.02 COMPONENTS

A. Studs: Cold-formed galvanized steel C – studs, in conformance with AISI Specifications for Design of Cold-formed Steel Structural Members.

1. Minimum stud thickness: 22-gauge (use 20-ga. studs @ door and borrowed lite jambs)
2. Web Size: As indicated on the drawings.
3. Flanges: Equal lengths 1-1/4 inches.

B. Runner Track: Cold-formed galvanized steel in conformation with AISI Specifications for Design of cold-formed steel structural Members.

1. Thickness equal to stud thickness minimum or heavier per design required.

C. Furring Channels: Cold formed galvanized steel in conformance with AISI Specifications for Design of cold-formed steel structural members.

1. ‘Z’-Furring: 25 gauge x 1 1/2 deep “z” profile with 3/4” wide flange for placement against the substrate and 1-1/4 inch wide flange for attachment of gypsum wallboard.
2. Hat-Channels: 25 gauge x 7/8” deep hat shaped corrosion-resistant framing component used to furr out masonry wall and ceiling assemblies.

2.03 ACCESSORIES

A. Bridging: 16 ga. corrosion-resistant galvanized steel U-shaped, 3/4” wide channels with clip angles for attachment to studs.

B. Fasteners: Self-drilling, self-tapping screws; steel, complying with ASTM C 1513; galvanized coating, plated or oil-phosphate coated complying with ASTM B 633 as needed for required corrosion resistance.

C. Touch-Up Paint: Provide stud manufacturer’s standard zinc rich, containing 95-percent metallic zinc.

2.04 MATERIALS

A. Cold-Formed Steel: Complying with ASTM A 1003/A 1003M; unless indicated otherwise.

- B. Galvanized Coating: G40 coating weight minimum, complying with ASTM C 645.

2.05 FABRICATION

- A. General: Framing components may be preassembled into panels prior to erecting.
- B. Fabricate panels square, with components attached in a manner so as to prevent racking or distortion.
- C. Cut all framing components squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Hold members positively in place until properly fastened.
- D. Fasteners: Fasten components using self-tapping screws or welding.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Prior to installation, inspect previous work of all other trades. Verify that all work is complete and accurate to the point where this installation may properly proceed in strict accordance with framing shop drawings.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 ERECTION

- A. Install cold-formed framing according to requirements of ASTM C 745.
- B. Framing Installation:
 - 1. Erect framing and panels plumb, level and square in strict accordance with approved drawings.
 - 2. Handle and lift prefabricated panels in a manner to not cause distortion in any member.
 - 3. Anchor runner track securely to the supporting structure. Install concrete anchors only after full compressive strength has been achieved.
 - 4. Butt all track joints. Securely anchor abutting pieces of track to a common structural element or splice them together.

5. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks.
6. Attach wall stud bridging in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations.
7. Provide temporary bracing until erection is completed.
8. Where indicated in the drawings, provide for structural vertical movement using means according to manufacturer's recommendations.
9. Studs that directly abut exterior walls shall be separated by placing a #15 asphalt felt strip between the stud wall and the exterior wall surface.

C. Framed Openings

1. Reference: The Gypsum Construction Handbook, Centennial Edition published by USG Corporation.
2. Door and borrowed lite jamb openings should be framed with double 20-ga. steel studs run continuous from floor to runner at top of partition. Provide cripple studs above header maintaining 1/2" clearance from double studs running continuous from floor track to top runner.
3. Double studs at jambs shall attached to floor anchors secured with no less than two suitable fasteners.

3.03 PROTECTION

- A. Protect installed products until completion of project.
- B. Replace damaged metal stud framing members prior to hanging gypsum board.

END OF SECTION 09 22 16

SECTION 09 24 00 – PLASTERING

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Provide all labor, material and equipment necessary for a complete installation of plastered interior surfaces as indicated on the drawings. Work shall include:
 - 1. Portland cement 3-coat plastering over metal lath and metal ceiling suspension components.
 - 2. Accessories in connection with plastering
 - 3. Acrylic finish

1.02 RELATED SECTIONS

- A. Section 07 92 00 – Sealants

1.03 SUBMITTALS

- A. SD-04 Samples : Submit two 12 inch square samples of plaster with acrylic finish in color(s) and texture(s) specified for preliminary approval.

1.04 REFERENCES

- A. ASTM C926 – Application of Portland Cement - Based Plaster
- B. ASTM C847 – Metal Lath
- C. ASTM C897 – Aggregate for Job-Mixed Portland Cement Based Plasters
- D. ASTM C932 – Surface-applied Bonding Agents for Exterior Plastering
- E. ASTM C1063 – Lathing and Furring for Portland Cement Plastering

1.05 SYSTEM DESCRIPTION

- A. Three-Coat System is an exterior finishing system and is comprised of: lath, scratch coat, brown coat, and a finish coat.

1.06 ENVIRONMENTAL CONDITIONS

A. Cement Plaster

1. Cold Weather
 - a. Do not use frozen materials
 - b. Do not apply cement plaster to frozen surfaces or surfaces containing frost.
 - c. Do not mix materials or apply cement plaster when ambient temperature is less than 40 degrees F.
2. Hot Weather
 - a. Protect cement plaster from uneven and excessive evaporation during hot, windy or dry weather.
 - b. In hot, windy or dry weather the cement plaster should be moistened down and then covered with a single sheet of clear polyethylene plastic.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Portland Cement Plaster

1. Gold Bond Building Products Div.
2. National Gypsum Co.
3. USG

B. Acrylic Finish

1. Sto
2. Dryvit
3. Synergy

2.02 PLASTER MATERIALS

A. Portland Cement Plaster Materials: As follows:

1. Cement, ASTM C 150, Type 1.
2. Masonry Cement ASTM C91.
3. Sand Aggregate: ASTM C 144 type used for cement plaster
4. Fiber for Base Coat: Alkaline resistant (AR) glass or polypropylene fibers, 1/2 inch long, free of contaminates, manufactured for use in Portland cement plaster.

B. Portland Cement Plaster Base Coat Proportions and Mixing: Comply with ASTM C926. Proportion materials by volume. Adjust mix proportions within limits specified to attain workability.

1. Base Coats: Ad follows:
 - a. Scratch Coat: 1 part Portland cement, one part Masonry cement, 2-1/2 to 4 parts sand.
 - b. Brown Coat: 1 part Portland cement, one part Masonry cement, 5 to 6 parts sand
2. Metal Lath: ASTM C847, galvanized Diamond mesh, 3.4 lbs/SY.
3. Fiber Content: Add fiber to base coat mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's directions but do not exceed 2 lbs. per cu. ft. of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.
4. Mixing Liquid: 3 parts water to one part acrylic admix.

C. Acrylic Finish: Factory mixed 100 percent pure acrylic finish with aggregate and integral color.

1. Color(s): As selected by the Architect from manufacturer's standard colors.

2.03 SUSPENSION SYSTEM

A. Suspension Channels: Cold-rolled steel, 0.05980 inch minimum thickness of base metal (uncoated) protected with rust inhibitive paint or galvanizing complying with ASTM A525 for G60 coating designation, and as follows:

1. Carrying Channels: 1 1/2 inches deep x 7/16 inch wide flanges, 475 lbs. per 1000 feet painted, 508 lbs per 100 feet galvanized.
2. Furring Channels: 3/4 inch deep x 7/16 inch wide flanges, 300 lbs per 1000 feet painted, 316 lbs per 1000 feet galvanized.
3. Hat Channels: 7/8 inch deep, zinc coated (galvanized) steel, minimum 0.0179 inch thick complying with ASTM A446, Coating Designation G60, grade A.
4. Provide galvanized channels for exterior installation and high moisture interior areas (shower rooms).

2.04 PLASTERING ACCESSORIES

A. Corner Mesh: Formed steel, minimum 26 gauge thick, expanded flanges shaped to permit complete embedding in plaster, minimum 2 in. wide, galvanized finish.

B. Metal Lath: 3.4 lb/yd² expanded metal, galvanized.

- C. Square Edge Casing Bead: Formed steel, minimum 24 gauge thick thickness governed by plaster thickness, maximum possible lengths, expanded metal flanges with square edges, galvanized finish.
- D. Flexible Corner Bead
- E. Drip Screed: Double-V expansion joint, zinc, with corrosion-resistant expanded flanges.
- F. Anchorages: Nails, staples, or other approved metal supports of type and size to suit application, galvanized to rigidly secure lath and associated metal accessories in place.
- G. Moisture Resistant Barrier Underlayment: 30-lb building paper.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine surfaces which are to receive plaster and accessories, and conditions under which plastering work is to be performed. Do not proceed with plastering work until unsatisfactory conditions have been corrected.
- B. Preparation
 - 1. Clean plaster bases and substrates to be plastered. Remove loose material, coating and other substances which might impair work.

3.02 INSTALLATION

- A. Plaster Suspension Grillage
 - 1. Install main carrying channels at 48" o.c. (or as required for fire-resistive assemblies), and within 6" of walls. Provide 1" clearance between runners and abutting walls and partitions. At channel splices, interlock flanges, overlap ends 12", secure each end with double-strand 18-ga. tie wire.
 - 2. Attach furring or hat channels at right angles to 1-1/2" carrying channels at 16" o.c., spacing furring within 6" of walls. Provide furring within 6" of walls and partitions. Attach furring channels with wire ties or furring channel clips installed on alternate sides of carrying channels. Saddle tie furring to channels with double-strand 18-ga. tie wire when clips cannot be alternated. At splices, nest furring channels with at least an 8" overlap and securely wire tie each end with double-strand 18-ga. tie wire.

3. A light troffers or any openings that interrupt the carrying or furring channels, install additional cross-reinforcing to restore the lateral stability of grillage.

4. Hanger wires are required within 12" on both sides of a pivoted splice clip. At Least one hanger wire is required within 12" of the transition clip. Do not support wires from mechanical and/or electrical equipment.

B. Lathing

1. Apply lath with long dimension across supports and with end joints staggered between courses. Lap ends of metal lath 1" and sides at least 1/2". If end laps occur between supports, they should be laced or tied with 18-ga. tie wire.

2. Secure lath to all supports at intervals not exceeding 6 inches. At all interior angels, metal lath should be formed into corners and carried out onto abutting surface.

C. Portland Cement Plaster

1. Nominal plaster base coat thickness:

- a. First coat 'scratch': 3/8 inch – 1/2 inch
- b. Second coat 'brown': 3/8 inch – 1/2 inch

2. Apply cement plaster with sufficient force (by hand or machine) to develop full adhesion between plaster and the substrate.

3. Apply first coat to completely embed lath. Cross rake slightly to provide key for second base coat. Coat must be uniform in thickness.

4. Apply second coat to provide the required total thickness. Coat must be uniform in thickness. Rod off to desired thickness, leveled to screeds, to provide a true flat plane. Follow this by wood floating or darbying the surface. Fill all voids and dress surface for acrylic finish.

5. Completed second coat of cement plaster shall cure completely, prior to application of acrylic finish. Follow manufacturer's recommendations. Generally, the minimum curing time is 7 days.

D. Control Joints

1. Perimeter isolation of suspended plaster shall be formed of Sheetrock Brand No. 66 zinc casing bead to maintain 1/4" wide continuous perimeter joint.

2. Interior ceiling areas should have control joints installed at a maximum of 30 feet 0.c. in either direction. Control joints shall be formed using Sheetrock Brand zinc control joints No. 50, 1/4" wide.

E. Acrylic Finish

1. Comply with manufacturer's instructions for mixing and application of acrylic finish.
2. Apply finish continuously and in one operation to the entire wall/soffit area maintaining a 'wet' edge so that completed finish is free of scaffold lines and other imperfections due to application methods.
3. Finish Coat: Using a stainless steel trowel, apply and level a coat of integral colored 100 % acrylic-based, aggregate textured finish to a uniform thickness.
 - a. Finish texture: Equal to Dryvit 'Limestone'

F. Cleaning: Remove spattering of plaster and acrylic finish from other finished surfaces.

END OF SECTION 09 24 00

SECTION 09 29 00 – GYPSUM BOARD

PART 1 - GENERAL

1.01 WORK INCLUDED

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

B. Work Includes

1. Gypsum Board & Joint Treatment
2. Gypsum Board Ceiling Suspension System
3. Acoustical Sound Attenuation Blanket Insulation
4. Drywall Moldings, Furring & Accessories

1.02 WORK INCLUDED UNDER THIS SECTION BUT SPECIFIED ELSEWHERE

- A. Section 06 10 00 – Rough Carpentry: Wood blocking
- B. Section 07 21 16 – Blanket Insulation
- C. Section 09 22 16 – Non-Bearing Metal Wall Framing
- D. Section 09 90 00 – Painting

1.03 REFERENCES

- A. ASTM C36 – Gypsum Wall Board
- B. ASTM C475 – Joint Treatment Materials for Gypsum Wallboard
- C. ASTM C 1002 – Gypsum Board Screws
- D. ASTM C514 – Nails for the Application of Gypsum Wallboard
- E. ASTM C 840 – The Standard Specification for Application and Finishing of Gypsum Board
- F. Gypsum Association publication GA 214-90: Recommended Specifications: Levels of Gypsum Board Finish.
- G. Fire-Resistance Ratings: Provide gypsum drywall construction fire-resistance ratings indicated, conforming to assemblies tested per ASTM E 119 by inspecting and testing organization acceptable to authorities having jurisdiction.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide gypsum board and related products by one of the following:

1. Georgia-Pacific Corp.
2. National
3. United States Gypsum Co.

2.02 MATERIALS

A. Standard Gypsum Board

1. Provide gypsum panels of types indicated in maximum lengths available to minimize end joints:
 - a. Standard Gypsum Board: ASTM C 36, ASTM C 1278 (Indicated on drawings as Gypsum Board).
 - 1) Type: Regular, unless otherwise indicated
 - 2) Type: Type X for fire-resistance-rated assemblies
 - 3) Thickness: 5/8 inch (unless noted otherwise)
 - 4) Edges: Tapered

B. Moisture Resistant Gypsum Board: ASTM C1396 and C630

1. Gypsum panels encased in moisture and mold resistant, 100% recycled green face and brown back papers.
 - a. ASTM C743 water absorption compliant.
 - b. Thickness: 5/8 inch (unless noted otherwise)
 - c. Edges: Tapered

C. Furring Channels: ASTM C 645; Cold formed galvanized steel in conformance with AISI Specifications for Design of Cold-formed steel structural members.

1. 'Z'-Furring: 25 gauge x 1 1/2" deep 'z' profile with 3/4" wide flange for placement against the substrate and 1-1/4 inch wide flange for attachment of gypsum wallboard.
2. Hat-Channels: 25 gauge x 7/8" deep hat shaped corrosion-resistant flaming component used to furr out masonry wall and ceiling assemblies.
3. Resilient Channels: single leg, 25 gauge x 1/2" deep resilient channels.

C. Steel Framing Components for Suspended Flat Ceilings

1. General: Provide components complying with ASTM C 754 for conditions indicated.
2. Wire Hangers: Galvanized carbon steel, soft temper, prestretched, 12-gauge wire.
3. Ceiling Suspension System
 - a. Main Carrying Channels: 1-1/2" high x 17/32" wide flange x 16-ga. cold-rolled channels.
 - b. Furring Channels: 20-ga. corrosion resistant roll-formed steel, hat-shaped sections, 7/8" high x 2-9/16" wide x 12' lengths.
 - c. Tie Wire: 8-ga. galvanized soft annealed wire.

B. Steel Framing Components for Suspended Gypsum Board Ceilings

1. General: Provide ASTM Class Heavy Duty components complying with ASTM C635.
2. Wire Hangers: Galvanized carbon steel, soft temper, prestretched, 12-gauge wire.
3. Suspension System
 - a. Main Tees: Fire-Rated Heavy Duty Classification, 144" long, with integral reversible splice with knurled face. 1-1/2" face, 1.617" high.
 - b. Cross Tees: 1-1/2" high x 48" long with 1-1/2" wide face.
 - c. Wall Moldings: Single web with knurled face, 1" x 1-1/2"

C. Trim Accessories: ASTM C 840: manufacturer's standard trim accessories, including corner bead and edge trim of beaded type with face flanges for concealment in joint compound except where semi-finishing or exposed type is indicated.

1. Provide corner bead formed from zinc alloy.
2. Provide zinc-alloy corner bead and edge trim for exterior gypsum board.
3. Provide one-piece control joints with 1/4 inch wide by 7/16 inch deep vee-shaped slot, covered with removable tape, of roll-formed zinc or extruded vinyl as recommended by gypsum board mfr.

D. Gypsum Board Joint Treatment Materials: ASTM C475 and ASTM C 840, and as follows:

1. Joint Tape: Paper reinforcing tape, unless otherwise indicated
2. Drying-Type Joint Compounds: Factory pre-packaged vinyl-based product complying with the following requirements:

- a. Taping compound formulated for embedding tape and first coat over fasteners and flanges of corner beads and edge trim
 - b. Topping compound formulated for fill (2nd) and finish (3rd) coats.
- E. Miscellaneous Materials: As follows, recommended by gypsum board mfr.
 - 1. Laminating Adhesives: Product recommended by gypsum board mfr.
 - 2. Fastening Adhesive for Wood: ASTM C557
 - 3. Gypsum Board Screws: ASTM C 1002
 - 4. Gypsum Board Nails: ASTM C 514
 - 5. Concealed Acoustical Sealant: Nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
- F. Sound Attenuation Fire Blankets (SAFB);
 - 1. Type: Un-faced mineral fiber blanket insulation.
 - 2. SAFB Thickness: 3 inches
 - 3. Density: 2.5 pcf nominal density
 - 4. Acceptable Manufacturers
 - a. Owens/corning Noise Barrier.
 - b. Manville Sound Control Batts.
 - c. Certainteed "Certasound".
 - d. Knauf Acoustical Blanket Insulation.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on the shop drawings.
- B. Beginning of installation means acceptance of existing surfaces.

3.02 METAL FURRING INSTALLATION

- A. Erect 'Z'-furring channels vertically against masonry walls as indicated on the drawings. Secure 'Z'-furring at maximum 24 inches on center with appropriate anchoring method. Provide shims behind furring channels as necessary to ensure a flush wall surface.

B. Space furring channels maximum 16 inches on center, not more than 2 inches from abutting walls. Continue furring channels from floor to 12" above finished ceiling at suspended ceiling locations.

3.03 CEILING SUSPENSION SYSTEM – FLAT CEILINGS

A. Install main carrying channels at 48" o.c. (or as required for fire-resistive assemblies), and within 6" of walls. Provide 1" clearance between runners and abutting walls and partitions. At channel splices, interlock flanges, overlap ends 12", secure each end with double-strand 18-ga. tie wire.

B. Attach furring channels at right angles to 1-1/2" carrying channels at 16" o.c., spacing furring within 6" of walls. Provide furring within 6" of walls and partitions. Attach furring channels with wire ties or furring channel clips installed on alternate sides of carrying channels. Saddle tie furring to channels with double-strand 18-ga. tie wire when clips cannot be alternated. At splices, nest furring channels with at least an 8" overlap and securely wire tie each end with double-strand 18-ga. tie wire.

C. A light troffers or any openings that interrupt the carrying or furring channels, install additional cross-reinforcing to restore the lateral stability of grillage.

D. Hanger wires are required within 12" on both sides of a pivoted splice clip. At least one hanger wire is required within 12" of the transition clip. Do not support wires from mechanical and/or electrical equipment.

3.04 ACOUSTICAL SEALANT

A. Prior to hanging gypsum board, apply continuous bead of acoustical sealant between floor track runner and concrete slab (both sides), and between wall studs and abutting walls.

3.05 INSTALLATION (GYPSUM BOARD)

A. Install and finish gypsum board to comply with ASTM C 840 and as follows:

B. Isolate drywall construction from abutting structural and masonry work; provide edge trim and acoustical sealant as recommended by mfr. NO RAW EDGES OF DRYWALL ACCEPTABLE.

C. Screw gypsum board to metal framing and 'Z' –furring channels.

D. Screw both layers to supports where double-layer work is indicated or otherwise required.

E. Direct bonding: Comply with manufacturer's recommendations where gypsum board is indicated to be directly bonded to substrate.

F. Do not bridge building expansion joints. Leave space of the width indicated between boards and trim both edges for installation of sealant or gasket.

G. Place control joints consistent with lines of buildings or as indicated on the drawings.

1. Maximum spacing of control joints shall comply with the following:
 - a. Interior Partitions: 30 ft.
 - b. Interior ceilings with perimeter relief: 50 ft. Max single area: 2,500 S.F.
 - c. Interior ceilings without perimeter relief: 30 ft. Max. single area: 900 S.F.
 - d. Exterior Ceiling/Soffit: 30 ft. Max. single area: 900 S.F.

H. Suspended Drywall Ceilings:

1. Apply gypsum panels first to ceiling and then to walls.
2. Attach gypsum panels to the suspension system main runners, cross tees and cross channels with conventional Mo.6 Type S Hi Lo bugle head, self-drilling, self-tapping steel screws spaced 8" o.c. at periphery of gypsum panels.
3. Lighting fixtures or troffers, air vents and other equipment shall be separately supported from the structure.
4. Control Joints: Provide USG control joint No. 093 where shown. Ceiling areas should not exceed 2,500 SF without perimeter relief.

3.06 DRYWALL FINISHING

A. Apply joint tape and joint compound at joints between gypsum boards. Apply compounds, indicated below at accessory flanges, penetrations, fastener heads and surface defects.

B. Install compound in 3 coats (plus pre-fill of cracks where recommended by manufacture); sand between coats and after last coat.

C. Joint Treatment:

1. Embedding and First Coat: Ready-mix drying type all-purpose taping compound.
2. Fill (Second) Coat: Ready-mix drying type all-purpose compound.
3. Finish (Third) Coat: Ready-mix drying type all-purpose compound.
4. Treat water-resistant gypsum, board joints, fastener heads, cut edges and penetrations in water-resistant backing board to comply with gypsum board manufacturer's directions.

D. Finish: Level 4 smooth finish (GA 214-96)

END OF SECTION 09 29 00

SECTION 09 31 00 – TILING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Applicable provisions of Division 1 shall govern all work under this section.
- B. Section Includes
 - 1. Porcelain ceramic wall and floor tile
 - 2. Setting materials and grout
 - 3. Waterproof membrane liner
 - 4. Transition strip accessories
 - 5. Substrate preparation
 - 6. Thick-set mortar bed
 - 7. Sealants and backer materials for joints in tile work.
 - 8. Final cleaning of tile surfaces

1.02 RELATED WORK

- A. Section 07 92 00 – Joint Sealants

1.03 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
 - 1. ASTM INTERNATIONAL (ASTM)
 - a. ASTM C 1027(2009) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
 - b. ASTM C 1028(2007e1) Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
 - c. ASTM C 648(2004; R 2009) Breaking Strength of Ceramic Tile
 - d. ASTM D 4068(2009) Chlorinated Polyethylene Sheeting for Concealed Water-Containment Membrane
 - e. ASTM E 2129(2005) Standard Practice for Data Collection for Sustainability Assessment of Building Products

2. GREEN SEAL (GS)
 - a. GS-36(2000) Commercial Adhesives
3. GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)
 - a. GEI Greenguard Standards for Low Emitting Products
4. TILE COUNCIL OF NORTH AMERICA (TCNA)
 - a. TCA Hdbk (2008) Handbook for Ceramic Tile Installation

1.04 SUBMITTALS

- A. Submit the following according to Section 01 33 00 – Submittals Procedure:
 1. SD-03 Product Data
 - a. Tile
 - b. Setting Adhesives
 - c. Sheet membrane waterproofing and crack isolation underlayment
 - d. Grout, and Adhesive
 2. SD-04 Samples
 - a. Tile
 - b. Sheet membrane waterproofing membrane
 - c. Trim accessories

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in a closed, unventilated environment.
- B. Maintain 50 deg. F during installation of mortar materials.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. For basis of design, the plans are based on tile products from Dal-Tile. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications. Manufacturer's wishing to submit alternate metal roofing products shall submit product data sheets and/or specifications.

1. Interceramic
2. Crossville Tile

B. Tile Setting Materials

1. Bostik
2. Custom Building Products
3. Laticrete International, Inc.
4. Hydroment
5. Mapei Corporation

C. Tile Grout

1. Polyblend
2. Mapei
3. Hydroment
4. TEC

2.02 SETTING MATERIALS

A. Latex-Portland Cement Mortar: ANSI A118.4, composed as follows:

1. Mixture of Dry-Mortar Mix and Latex Additive: Mixture of prepackaged dry-mortar mix and liquid-latex additive complying with the following requirements:
 - a. Latex Additive: Manufacturer's standard.
 - b. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

2.03 GROUTING MATERIALS

A. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:

B. Mixture of Dry-Grout Mix and Latex Additive: Mixture of factory-prepared, dry-grout mix and latex additive complying with the following requirements:

1. Unsanded Dry-Grout Mix: Dry-set grout complying with ANSI A118.6 for materials described in Section H-2.3, for joints 1/8 inch and narrower.
2. Latex Additive: Manufacturer's standard.
3. Color(s): As selected from manufacturer's full range of color choices.

2.04 ANTIFRACTURE/WATERPROOF MEMBRANE

A. Liquid latex waterproofing and crack prevention membrane complying with ASTM A118.10 and A118.12.

1. Manufacturers:
 - a. Greenseel Products
 - b. Custom Building Products 'RedGard'

2.05 ELASTOMERIC SEALANTS

A. Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Section 07 92 00 - Joint Sealants.

Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

2.06 METAL TRANSITION STRIPS

A. Manufacturer: For basis of design, the plans are based on metal transition products from Schluter® Systems. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications.

B. Flooring Applications

1. Floor Tile To Resilient Flooring Schluter® RENO-U
2. Floor Tile Movement Joint.....Schluter® DECO
3. Floor Tile To Carpet Schluter® SCHIENE
4. Floor Tile To Exposed Slab Schluter® RENO-RAMP

C. Wall Tile Vertical Outside Edge Protection Trim

1. Schluter Systems 'JOLLY', aluminum with trapezoid-perforated anchoring leg that is secured in the mortar bond coat beneath the tile.

D. Wall Tile Top Edge Protection

1. Schluter Systems 'RONDEC', radiused aluminum with trapezoid-perforated anchoring leg that is secured in the mortar bond coat beneath the tile.

2.07 CERAMIC TILE SCHEDULE

A. Wall Ceramic Tile (WCT)

1. Daltile 'Brixton™ Glazed Ceramic
2. Size: 6" x 6"
3. Color: 'Bone' BX01
4. Base: Use same 6" x 6" square edge.

- B. Floor Porcelain Tile (P.T.)
 - 1. Daltile 'City View™'
 - 2. Size: 12" x 12"
 - 3. Color: 'Downtown Nite' CY04

PART 3 - EXECUTION

3.01 WALL SUBSTRATE PREPARATION

A. Examine concrete masonry surfaces which are to receive ceramic tile to assure that surfaces are stable, flat, firm, dry, clean. Remove protrusions, bumps, and ridges by sanding.

3.02 INSTALLATION - GENERAL

A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

B. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated.

C. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated.

D. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Adjust layout to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

E. Grout tile to comply with the requirements of the following tile installation standards:

- 1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

F. Wall Tile Installation: Install tile to comply with requirements indicated, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.

- 1. Joint Widths: 1/8 inch

3.02 INSTALLATION – THIN SET METHOD

- A. Install in compliance with TCA Installation Method F113-09.

3.03 INSTALLATION – FULL MORTAR BED METHOD

- A. In areas where waterproofing is required, pour reinforced cement mortar bed and install waterproof membrane, tile, and grout according to TCA Installation Method F121-09.
 - 1. Applicable Locations: Toilet and shower rooms
- B. Slope mortar bed to floor drains as indicated on the drawings.
- C. Lay tile to pattern indicated on the drawings.
- D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor and base joints.
- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight without voids, cracks, excess mortar, or excess grout.
- F. Sound tile after setting. Replace hollow sounding units.
- G. Keep expansion and control joints free of mortar or grout. Apply sealant to joints.
- H. Grout tile joints.
- I. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 CLEANING AND PROTECTION

- A. If one has been used, remove grout release and clean tile surfaces so they are free of grout residue and foreign matter, according to manufacturer's instructions. If a grout haze or residue remains, use a suitable grout haze remover or cleaner and contact grout manufacturer for recommendations. Flush surface with clean water before and after cleaning. Do not use harsh hydrochloric, muriatic or sulfuric acid or acid-based cleaners to clean glazed tiles or tiles grouted with latex modified grout.
- B. When a heavy residue of Portland cement grout is present, acceptable tile cleaning acids may be used. However, the grout should be allowed to cure a minimum of 10 days before this aggressive cleaning method is employed. Tile and grout shall be soaked with water before cleaning. In the absence of a recommendation from the grout manufacturer, acid cleaning may be done with a saturated solution of phosphoric or sulfamic acid, mixed according to manufacturer's recommendations.

C. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

END OF SECTION 09 31 00

SECTION 09 51 00 – ACOUSTICAL TILE CEILINGS

PART 1 – GENERAL

1.01 WORK INCLUDED

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

B. Work Includes

1. Suspended metal grid ceiling system.
2. Acoustical tile
3. Accessories

1.02 RELATED WORK

A. Section 12 20 00 – Window Treatment: Recessed Solar Shade Ceiling Pocket

B. Division 23 – Mechanical: Air diffusion grilles in ceiling system

C. Division 26 – Electrical: Light fixtures in ceiling system

1.03 REFERENCES

A. ASTM C635 – Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

B. ASTM C636 – Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C. FS HH-I-521 – Insulation Blankets, Thermal Mineral Fiber, for Ambient Temperatures

1.04 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-03 Product Data
2. SD-04 Samples: 6-inch square samples of each acoustical panel type, pattern, and color. Set of 12-inch long samples of exposed suspension system members, including moldings, for each color and system type required.

1.05 FIRE-TEST-RESPONSE CHARACTERISTICS

A. Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
 - a. Flame spread: 25 or less.
 - b. Smoke developed: 50 or less.

1.06 GUARANTEE

A. Manufacturer's 30-year limited warranty against sagging or warping due to humidity conditions, mold/mildew, and bacterial growth.

B. Suspension Grid: Provide written guarantee of no visible red rust on exposed to view surfaces for 10 years from date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS- ACOUSTICAL TILE

A. Acoustical Panel Products:

1. Armstrong World Industries, Inc.
2. CertainTeed
3. USG Interiors Inc.

2.02 MANUFACTURERS – SUSPENSION GRID

A. Subject to compliance with requirements, provide products from one of the following:

1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation.
3. USG Interiors, Inc.
4. CBI USA.

2.03 MATERIALS

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Test Method for Ceiling Attenuation Class (CAC): Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.
- B. Nodular, Cast, or Molded, (Type III, Form 1) or Water-Felted, (Type III, Form 2) Mineral-Base Acoustical Panels, per ASTM E 1264, with painted finish, complying with pattern and other requirements indicated below:
- C. Ceiling panels shall be humidity resistant and treated with special biocide that inhibits the growth of mold or mildew associated with prolonged high humidity conditions.
- D. Ceiling Tile Schedule (Mineral Base Acoustical Panels)
- AT-1** 24" x 24" x 5/8" Angled tegular edge
NRC .55
CAC 35
Light Reflectance 0.84 min.
Fire Resistance: Class 'A'
1. Manufacturers: Armstrong #1732 *Fine Fissured* w/ Humiguard Plus or approved equivalent products from Celotex and USG subject to approval by Architect.
- E. Suspension System Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
1. Cast-In-Place and Post-installed Anchors in Concrete: Cast-in-place or expansion anchors, with holes or loops for attachment of hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E 488, conducted by a qualified testing agency.
 2. Powder-Actuated Fasteners in Concrete: Fastener system fabricated from corrosion-resistant materials, with clips or other accessory devices for attachment of hangers, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing agency.
- F. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated Carbon Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.

2. Nickel-Copper Alloy Wire/Fasteners: Provide Monel (L.D. Peters (800) 221-9933) nickel- copper alloy suspension wire, or equal, and nickel-copper alloy fasteners/anchors where low PH and/or high chlorine conditions exist (example: pool). Comply with ASTM B 164 for UNS N04400 alloy.

3. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

G. Sheet-Metal Edge Moldings and Trim: Type and profile indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners. Provide manufactured shapes of proper size(s) where ceiling mouldings abut radiused materials (radiused block, round columns, etc.)

1. Wall Edge Molding: Provide manufacturer's standard angle type wall channel.

2. Non-Fire-Resistance-Rated, Direct-Hung Suspension Systems: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements:

3. 15/16" Grid Face, Capped, Steel Suspension System: Main and cross runners roll formed from minimum G-30 hot-dipped galvanized/electro-galvanized/prime painted (guaranteed 15 years against any visible red rust on exposed to view surfaces), cold-rolled steel sheet, with prefinished metal caps on flanges; other characteristics as follows:

a. Structural Classification: Intermediate-duty system.

b. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.

c. Cap Material and Finish: Steel sheet painted to match color indicated by manufacturer's standard color designations.

2.04 ATTIC STOCK

A. Prior to project close-out, deliver replacement material to Owner in the amount of one (1) box for every fifty (50) installed, or fraction thereof (2 boxes minimum), of each type, pattern, color or size.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
 2. Balance ceiling borders on opposite sides, using more-than-half-width acoustical units.
- B. Suspend ceiling hangers as follows:
1. Secure wire hangers to ceiling suspension members and to supports above. Connect hangers either directly to structures or to inserts, eye screws, or other devices that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 2. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Secure to building structure with screw anchors spaced 16" o. c. Mitre corner joints.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members. Cope exposed edges of intersecting exposed suspension members to produce flush intersections.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.

END OF SECTION 09 51 00

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Work Includes
1. Heterogeneous sheet vinyl flooring
 2. Vinyl wall base

1.02 RELATED SECTIONS

A. Section 09 31 00 – Tiling: Flooring Transition Strip

1.03 SUBMITTALS

A. Submit the following according to Section 01 33 00 – SUBMITTAL PROCEDURES:

1. SD-03 Product Data
 - a. Manufacturer's product data and installation instructions for each type of resilient flooring.
2. SD-04 Samples
 - a. Samples of each type, color and pattern of resilient flooring and accessories; full size for tile
3. SD-10 Maintenance instructions for each type of flooring.

1.04 WARRANTY

A. Submit copies of manufacturer's standard warranty against material and/or manufacturing defects.

PART 2 – PRODUCTS

2.01 SHEET VINYL FLOORING

A. Manufacturers:

1. For basis of design, the plans are based on the sheet vinyl as manufactured by Polyflor 2000 PUR
2. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications. Manufacturer's wishing to submit alternate sheet vinyl products shall submit product data sheets and/or specifications.
 - a. Armstrong Commercial Flooring
 - b. Mannington

B. Materials

1. Composition: Homogenius polyurethane reinforced cross linked and UV cured sheet flooring.
2. Gauge: 2 mm
3. Sheet Size: 6' – 6"

4. Fire Test Data: ASTM E648 Class 1
5. Abrasion Resistance: Group M
4. Smoke Developed: 450 or less
5. Static Load Limit: ASTM F 970 Modified 750 psi

2.02 VINYL WALL BASE

A. Manufacturers

1. For basis of design, the plans are based on the resilient wall base as manufactured by Armstrong.
2. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications.
 - a. Johnsonite, Chagrin Falls, OH: 'Traditional' collection
 - b. Roppe
 - c. VPI

B. Material: ASTM F 1861-98; 4" high; 0.125" gage; with matching stops; standard top-set cove unless otherwise indicated. Provide base in 96'-0" rolls (4'-0" lengths not acceptable).

C. Colors

1. Armstrong 'Graphite Gray 61'

PART 3 – EXECUTION

3.01 EXAMINATION

A. Beginning of installation means acceptance of existing substrate and site conditions.

3.02 PREPARATION

A. Apply primer to concrete substrates as recommended by flooring manufacturer.

3.03 INSTALLATION

A. Comply with flooring manufacturer's recommendations for type(s) of materials, adhesives, project conditions, and intended use.

3.04 CLEANING

A. Clean floors and accessories after installation according to flooring manufacturer's instructions.

END OF SECTION 09 65 00

SECTION 09 68 00 – CARPETING

PART 1 – GENERAL

1.01 SECTION INCLUDES

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

B. Section includes;

1. Modular carpet tile
2. Stitched carpet wall base with same pattern as modular carpet tile

1.02 REFERENCES

A. ASTM E84 – Surface Burning Characteristics of Building Materials

1.03 SUBMITTALS

A. SD-03 Submit Product Data for each type of carpet, and the following:

B. SD-04 Samples two full tile samples illustrating color and pattern for each carpet material specified.

C. SD-08 Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1. Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Contractors Certification: Provide certification testifying installation contractor is certified by the Floor Covering Installation Board (FCIB).

1.05 WARRANTY

A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

B. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.

- C. Chair pads must not be required for carpet warranty coverage.
- D. Warranty shall be for a specifically defined non-prorated period of 15 years. "Lifetime" warranties are not acceptable.
- E. Warranty shall not exclude carpet product installed on stairs provided it is properly installed and maintained.
- F. The non-prorated twenty-year warranty shall specifically warrant against:
 - 1. Excessive Surface Wear: More than 15% loss of pile fiber weight.
 - 2. Excessive Static Electricity: More than 3.0 kV per AATCC 134.
 - 3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency.
 - 4. Delamination
 - 5. Edge Ravel (Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.)
 - 6. Zippering

1.06 PROJECT CONDITIONS

- A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.
- B. The maximum amount of moisture evacuation from the floor is 3.0 pounds per 1,000 square feet in 24 hours. The acceptable pH level of the substrate is between 7.0 and 9.0. Flooring contractor is responsible for floor testing.
- C. All material used in the sub-floor preparation and repair shall be recommended by the carpet manufacturer and shall be chemically and physically compatible with the carpet system being bid.
- D. Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. For basis of design, the plans are based on Interface 'Kamala II'
- B. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications. Manufacturer's wishing to submit alternate carpet products shall submit product data sheets and/or specifications.

1. C & A Floorcoverings
2. Mannington
3. Patcraft
4. J&J Commercial

2.02 MATERIALS

A. Modular Carpet Tile

1. Tufted texture loop
2. Antimicrobial Treatment: (AATCC 138 Washed) (AATCC 174 Parts 2 & 3)
3. Soil/Stain Protection: Protekt® with Duratech®
4. Size: 50 cm x 50 cm.
5. Dye Method: 100% Solution Dyed
6. Pile Density: 5,667 oz/SY
7. Backing: GlasBac® Tile

B. Performance Specifications

1. Indoor Air Quality: Green Label Plus Certified #GLP0820
2. Radiant Panel: (ASTM E-648) Class 1
3. Smoke Density: ASTM E – 662

C. Trowelable Underlayments and Patching Compounds: As recommended by the carpet manufacturer.

1. 3000 psi minimum Portland cement based leveling compound and substrate primer according to carpet manufacturer's recommendations.

2.03 CARPET COLOR: 101587 'Saki'

2.04 STITCHED CARPET BASE

A. Provide matching 4 inch high stitched edge carpet base where indicated on the plans and Room Finish Schedule.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 feet, and are ready to receive work.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler. Use leveling and patching compounds to fill cracks, holes, and depressions in subfloor as recommended by the Carpet manufacturer.
- B. Clean floors and apply min. 3000 psi. Portland cement based leveling compound and substrate primer if required, according to flooring manufacturer's instructions. Start of laying flooring product will indicate acceptance of floor slab conditions.
- C. Prohibit traffic from area until filler is cured.
- D. Vacuum clean substrate.
- E. Project Conditions: Comply with CRI 104, Section 6: "Site Conditions."
- F. Subfloor Moisture Conditions: Provide moisture content, vapor emission, and alkalinity testing of the concrete slab, as well as all other tests recommended by the carpet manufacturer and adhesives. Tests shall indicate (in addition to other information) if slabs pass the following:
 - 1. Verify that concrete floors are dry to a maximum moisture content of 7 percent and exhibit Negative alkalinity, carbonization, or dusting. Submit testing results to the engineer.
- G. Remove subfloor coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone.
- H. Apply manufacturer's recommended Primer Barrier Coating over entire surface.

3.03 INSTALLATION

- A. Apply TacTiles at each corner along anchor rows and perimeter walls according to manufacturer's guidelines.
- B. TacTiles must be applied under every cut tile and any adjoining tile to the cut tile. Install TacTile on any area that will be exposed to high foot traffic and/or heavy rolling traffic.
- C. Vacuum carpet using commercial machine with face-beater element.
- D. Clean carpet to remove spots and soiling. Replace carpet tile where spots cannot be removed. Remove adhesive from carpet surface with manufacturers recommended cleaning agents. Remove protruding face yarns according to manufacturer's recommendations.
- E. Remove and dispose of debris and unusable scraps.

F. Protection: Comply with CRI 104, Section 15: "Protection of Indoor Installation."

G. Apply stitched carpet base to all wall surfaces or recessed toe-kick spaces at built-in base cabinets.

END OF SECTION 09 68 00

SECTION 09 90 00 – PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the plans indicate that a surface or material is not to be field painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the engineer will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefabricated items, concealed surfaces, finished metal surfaces, operating parts, labels.

1. Prefabricated items include but are not limited to the following factory-finished components:

- a. Flush wood doors
- b. Overhead sectional doors
- c. Architectural casework.
- d. Finished mechanical and electrical equipment.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

- a. Ceiling plenums.
- b. Pipe spaces.
- c. Duct shafts.

3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Copper.
4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 3 Section "Cast in Place Concrete" for surface preparation of exposed interior concrete finishes.
2. Section 04 20 00 – Unit Masonry: Field applied sealer to ground faced CMU surfaces.
3. Section 05 50 00 – Metal Fabrications
4. Section 05 52 13 – Pipe & Tube Railings
5. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
6. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
7. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.

3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 - Submittal Procedures.
- B. SD-03 Product Data: Submit manufacturer's technical information, label analysis, and application instructions for each paint material proposed for use.
 1. List each material and cross-reference specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
 2. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).
- C. SD-04 Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions; define specific products to be used for each coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture is achieved.
 1. Submit samples for the Architect's review of color and texture only:
 - a. Submit 3 drawdowns of each product and color combination. Drawdowns shall be applied using a 4 mil WFT drawdown bar on Leneta form WD plain white coated cards size 3 7/8" x 6". Label each card with the job name, date, product name, product number and color number as stated in the Color Schedule.
 2. SD-04 Samples for initial color selection in the form of manufacturer's color charts shall be submitted to the engineer for color selection. Field samples on various surfaces to be finished may be requested by the engineer.
- D. SD-08 Maintenance data for each product specified, to include in Operating and Maintenance Manual specified in Division 1.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

- 1. Product name or title of material.
- 2. Product description (generic classification or binder type).
- 3. Manufacturer's stock number and date of manufacture.
- 4. Contents by volume, for pigment and vehicle constituents.
- 5. Thinning instructions.
- 6. Application instructions.
- 7. Color name and number.
- 8. VOC content.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

- 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.07 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.08 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

1. Quantity: Provide one gallon of each type of stain and paint to Owner.
2. Provide formulation of each paint product and color used on project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. For basis of design, the plans are based on the following paints, coatings and stains from The Sherwin-Williams Company.

B. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications. Manufacturer's wishing to submit alternate paint products shall submit paint product data sheets and/or specifications cross referenced from the Sherwin Williams paint numbers listed in this Section.

1. Pittsburgh (PPG).
2. Hallman/Lindsay (HL).
3. ICI Paints (ICI).
4. Mautz Paint (MP).

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: For basis of design, the color selections listed in the Color Schedule are based on the paints, coatings and stains from The Sherwin-Williams Company.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the engineer about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including chair rail, counter edge bands, and shelving.
 - c. When transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer on metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush or roller according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

1. Items to be painted include: Piping and accessory items.

F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

3.04 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by engineer.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

C. Paint plywood equipment boards in their entirety prior to the installation of equipment. Coordinate this Work with other trades.

3.06 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a rust-inhibitive primer.

a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.

2) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.

3) P & L: S 4551 Tech-Gard High Performance Rust-Inhibitor Primer.

4) S-W: Kem Kromik Metal Primer B50N2/B50W1.

b. First and Second Coats: Full-gloss, exterior, alkyd enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 3.0 mils (0.076 mm).

1) Moore: Impervo Enamel #133.

2) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.

3) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.

4) S-W: Industrial Enamel B-54 Series.

B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:

1. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a galvanized metal primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

1) Moore: IronClad Galvanized Metal Latex Primer #155.

2) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.

3) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.

4) S-W: Galvite Paint B50W3.

b. First and Second Coats: Full-gloss, exterior, alkyd enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

1) Moore: Impervo Enamel #133.

2) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.

3) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.

4) S-W: Industrial Enamel B-54 Series.

C. Aluminum: Provide the following finish systems over exterior aluminum surfaces that are not factory finished.

1. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a primer.
 - a. Primer: Rust-inhibitive, acrylic- or alkyd-based, metal primer, as recommended by the manufacturer for use over aluminum, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).
 - 1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
 - 2) PPG: 90-709 Pitt-Tech Primer.
 - 3) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
 - 4) S-W: Pro-Cryl Universal Water Based Primer B66-310.
 - b. First and Second Coats: Full-gloss, alkyd enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).
 - 1) Moore: Impervo Enamel #133.
 - 2) PPG: 6-282 Speedhide Interior/Exterior Gloss Oil Enamel.
 - 3) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
 - 4) S-W: Industrial Enamel B-54 Series.

3.07 INTERIOR PAINT SCHEDULE

A. Concrete Masonry Units: Where scheduled, provide the following finish systems over interior concrete masonry block units:

1. Semigloss, Alkyd-Enamel Finish: 2 finish coats over an undercoat and a filled surface.
 - a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 5.0 mils (0.13 mm).
 - 1) Moore: Moorcraft Interior & Exterior Block Filler #173.
 - 2) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
 - 3) P & L: Z 98 Pro-Hide Plus Latex Block Filler.
 - 4) S-W: Prep-Rite Blockfiller B25W25.
 - b. Undercoat: Interior, alkyd- or latex-based, enamel undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
 - 1) Moore: Moore's Alkyd Enamel Underbody #217.
 - 2) PPG: 6-855 Speedhide Interior Latex Enamel Undercoater.

- 3) P & L: S/D 1012 Suprime "12" Interior Alkyd Wall Primer.
- 4) S-W: Promar 200 Alkyd Semi-Gloss
- c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
 - 1) Moore: Satin Impervo #235.
 - 2) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
 - 3) P & L: S/D 5700 Series Cellu-Tone Alkyd Satin Enamel.
 - 4) S-W: Promar 200 Alkyd Semi-Gloss

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

- 1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
 - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
 - 1) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
 - 2) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
 - 3) P & L: Z/F 1004 Suprime "4" Interior Latex Wall Primer.
 - 4) S-W: PrepRite 200 Interior Latex Primer
 - b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).
 - 1) Moore: Moore's Regal AquaVelvet #319.
 - 2) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
 - 3) P & L: Z/F 4000 Series Accolade Interior Velvet.
 - 4) S-W: ProMar 200 Interior Latex Eg-Shel B20 Series

C. Stained Woodwork: Provide the following stained finishes over, interior woodwork:

- 1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sealer coat and an alkyd-based, interior wood stain. Wipe wood filler on open grain woods before applying stain.
 - a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.
 - 1) Moore: Benwood Paste Wood Filler #238.
 - 2) PPG: None required.
 - 3) P & L: None required.
 - 4) S-W: Sher-Wood Natural Filler.

- b. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.
 - 1) Moore: Benwood Penetrating Stain #234.
 - 2) PPG: 77-302 Rez Interior Semi-Transparent Stain.
 - 3) P & L: S-Series Tonetic Wood Stain.
 - 4) S-W: Oil Stain A-49 Series.
- c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
 - 1) Moore: Moore's Interior Wood Finishes Quick-Dry Sanding Sealer #413.
 - 2) PPG: 77-30 Rez Interior Quick-Drying Sealer and Finish.
 - 3) P & L: H-40 Sanding Sealer.
 - 4) S-W: Wood Classics FastDry Sanding Sealer B26V43.
- d. First and Second Finish Coats: Alkyd-based or polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.
 - 1) Moore: Benwood Satin Finish Varnish #404.
 - 2) PPG: 77-7 Rez Varnish, Interior Satin Oil Clear.
 - 3) P & L: H24 38 Clear Finish Gloss.
 - 4) S-W: FastDry Oil Base Varnish, Gloss A66-300.

D. Ferrous Metal and Plywood Equipment Boards: Provide the following finish systems over ferrous metal:

- 1. Full-Gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
 - a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
 - 1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
 - 2) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
 - 3) P & L: S 4551 Tech-Gard High Performance Rust Inhibitor Primer.
 - 4) S-W: Kem Kromik Metal Primer B50N2/B50W1.
 - b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).
 - 1) Glidden: 6900 Series Lifemaster Pro Hi-Performance Acrylic Coating.
 - 2) Moore: Impervex Enamel #309.
 - 3) PPG: 51 Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel.
 - 4) P & L: Z/F 4400 Series Accolade Interior High Gloss.
 - 5) S-W: ProMar 200 Interior Latex Gloss Enamel B21W201.

E. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

1. Full-Gloss, Acrylic-Enamel Finish: 2 coats over a primer.
 - a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
 - 1) Moore: IronClad Galvanized Metal Latex Primer #155.
 - 2) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - 3) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
 - 4) S-W: Galvite Paint B50W3.
 - b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).
 - 1) Moore: Impervex Enamel #309.
 - 2) PPG: 51 Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel.
 - 3) P & L: Z/F 4400 Series Accolade Interior High Gloss.
 - 4) S-W: Industrial Enamel B54YZ37.
2. Color: For interior piperrails, handrails, guardrails, and steel tube curbs at inspection pits, paint safety yellow.

F. Interior Metal Decks Exposed To View:

1. Dry Fall Flat Finish: 2 finish coats over a primer.
 - a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.0 mils.
 - 1) S-W: Kem Bond HS.
 - b. First and Second Coats: Dry fall flat white modified alkyd paint for interior use, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 4.0 mils.
 - 1) S-W: Dry Fall Flat White B48W60.

G. Traffic Striping on Interior Concrete Floors: Provide the following finish systems as indicated on the drawings:

1. Two-component, 100% Solids Epoxy, Rust-Oleum 6500 System, Mautz Paint Co.
 - a. Preparation: Per manufacturer's instructions.
 - b. Application: Per manufacturer's instructions.
2. Color: For interior traffic striping, paint safety yellow.

END OF SECTION 09 90 00

SECTION 09 96 00 – HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

B. Work Includes:

1. Surface preparation of concrete floor slab and masonry wall surfaces (where cove base is required).
2. Field application of high-performance coating systems to floor slabs and vertical concrete wall surfaces in Inspections Pits.
3. Application of high-performance coating cove base to concrete masonry wall surfaces in Inspections 124.
4. Adhesive backed slip-resistant stair nosing treads at concrete stairs to inspection pits.

1.02 RELATED SECTIONS

A. Section 03 30 00 – Concrete

B. Section 04 20 00 – Unit Masonry

1.03 SUBMITTALS

A. SD-03 Product Data: Submit manufacturer's product data, including physical properties, chemical resistance, surface preparation and application instructions.

1. Submit manufacturer's standard warranty and applicator's warranty.

B. SD-04 Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

C. SD-04 Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Provide stepped Samples defining each separate coat, including primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

2. List of material and application for each coat of each sample. Label each sample for location and application.
3. Submit samples on the following substrates for Architect's review of color and texture:
 - a. Concrete: Provide two 4-inch- square samples for each color and finish.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.
- B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.
- C. Pre-Application Meeting: Convene a pre-application meeting two weeks before the start of application of floor coating system. Require attendance of parties directly affecting work of this section, including the Contractor, engineer, Applicator and Manufacturer's Representative. Review the surface preparation, application, cleaning, protection, coordination with other work, and benchmark finish samples to demonstrate the basis of acceptance for the work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store and handle materials according to manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the product indicated in the coating system descriptions.

2.02 COATING MATERIALS, GENERAL

- A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions clearly indicating comparable performance.

C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.

2.03 INTERIOR HIGH PERFORMANCE COATING SYSTEMS

A. High Traffic Coating System (HTCS): Where indicated on the room finish schedule, provide a two-component moisture cured urethane, VOC-HTS™ - High Traffic System by TENNANT COMPANY, Minneapolis, MN, 800-228-4943, or approved equal.

1. Percent Solids, ASTM D2369
 - a. Part A - 62.29%
 - b. Part B - 100.00%
 - c. Mixed - 68.71%
2. Volatile Organic Compound (VOC), ASTM D3960
 - a. 3.30 lb/gal or 400 g/L
3. Abrasion Resistance, ASTM D406
 - a. 30-40 mg loss at 1000 revolutions
 - b. 120-130 mg loss at 5000 revolutions
4. Tensile Strength, ASTM D2370
 - a. 5,300 psi or 36,570 kPa
5. Percent Elongation, ASTM D2370
 - a. 5%
6. Sward Hardness, ASTM D2134
 - a. 30-40 (1 mil film)
7. Bonding Additive: Manufacturer's standard.
 - a. Solvent free
8. Colorant: Manufacturer's standard pigmented colorant as selected by the engineer from manufacturer's full range.

9. Joint Filler: Manufacturer's standard joint filler.

10. Finish: Semigloss finish (a to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter).

2.04 ADHESIVE BACKED SLIP-RESISTANT STAIR NOSING TREADS

A. High-friction, slip-resistant tape, 2" wide x 60 ft. rolls, safety yellow, coated on the backside with a pressure-sensitive adhesive covered by a removable protective liner.

B. Manufacturers:

1. 3M™ Safety-Walk™ 500 Series
2. Safe Way Traction Pressure sensitive traction tape
3. Wooster Products, Inc., Flex-Tred anti-slip tape

PART 3 - EXECUTION

3.01 EXAMINATION

A. With applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.

1. Allow concrete substrate to cure a minimum of 30 days.
2. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry. Use a Delmhorst moisture meter to check the moisture content of concrete. An unacceptably high reading is 22 or above on a wood scale.
3. Start of application is construed as Applicator's acceptance of surfaces within that particular area.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
 - a. Confirmation of primer's suitability for expected service conditions.
 - b. Confirmation of primer's ability to be top coated with materials specified.

C. Notify engineer about anticipated problems before using the coatings specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.

2. Cementitious Substrates: Prepare concrete surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.

- a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.

- b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

D. Joint Treatment: Diamond crack saw and clean all expansion joints and fill joints with manufacturer's compatible joint filler, then shave joints smooth and level.

E. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.

2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Use only the type of thinners approved by manufacturer and only within recommended limits.

3.03 APPLICATION

A. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 - a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required is the same regardless of application method.
 - a. Omit primer on metal surfaces that have been shop primed and touchup painted.
 - b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 - c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.

- d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
 2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.
- C. Application Procedures: Apply coatings by brush, roller, or other applicators according to manufacturer's written instructions.
 1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
 - a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
 - b. Brush out and work brush coats into surfaces in an even film.
 - c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
 3. Spray Equipment: Use of spray equipment is not permitted.
- D. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
 1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.
- F. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.04 ADHESIVE BACKED SLIP-RESISTANT STAIR NOSING TREADS

- A. Prep and clean concrete stair tread surfaces as recommended by tape manufacturer.

B. Apply adhesive backed nosing tread tape continuous from wall to wall at each tread. Locate edge of tape 1 inch back from edge of tread.

C. Test all adhesive strips and replace sections that fail to adhere properly to concrete substrate.

3.05 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by engineer, and leave in an undamaged condition.

1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.

2. Close job site to traffic for a period of 24 hours after coating application.

3. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION 09 96 00

END OF DIVISION 09 - FINISHES

DIVISION 10 – SPECIALTIES

SECTION 10 11 00 – VISUAL DISPLAY SURFACES

PART 1 - GENERAL:

1.01 SCOPE OF WORK

- A. Applicable provisions of Division 1 shall govern the work under this Section.
- B. Section includes;
 - 1. Porcelain Enamel Markerboards
 - 2. Vinyl-Fabric-Faced Tackboards

1.02 RELATED WORK

- A. Section 06 10 00 – Rough Carpentry: Wall backing

1.03 SUBMITTALS

- A. SD-02 Shop Drawings: Include sections of trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
- B. SD-04 Samples: For selection of colors, patterns, and textures and verification of compliance with requirements.
 - 1. Porcelain Enamel Markerboard: Sample panels showing full range of colors available.
 - 2. Vinyl-fabric-faced Tackboards: Color charts showing full range of colors, textures, and patterns available.
 - 3. Aluminum Trim and Accessories: Samples of each finish and color showing full range of colors.

1.04 WARRANTY

- A. Porcelain Enamel Markerboard Warranty: Furnish written warranty, agreeing to replace markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking, provided manufacturer's instructions with regard to handling, installation protection, and maintenance have been followed.

PART 2 - PRODUCTS:

2.01 MANUFACTURERS

1. PolyVision Corp.
2. Platinum Visual Systems
3. Claridge Products and Equipment, Inc.
4. Neal Slate Co.

2.02 MATERIAL

A. Porcelain Enamel Markerboards: Balanced, high-pressure laminated porcelain enamel markerboards of 3-ply construction consisting of face sheet, core material, and backing.

1. Face Sheet: 24-gage enameling-grade steel. Coat exposed face and edges with 3-coat process consisting of primer, ground coat, and color cover coat, and concealed face with 2-coat process consisting of primer and ground coat. Fuse coats to steel at not less than 1200 deg F (649 deg C). Color as selected by Architect from manufacturer's standard colors.
 - a. Cover Coat: Matte finish cover coat.
 - b. All boards up to 16'-0" to be seamless.
2. Core: 3/8-inch-thick particleboard, ANSI A208.1, Grade 1-M-1.
3. Backing Sheet: 0.015-inch-thick aluminum sheet.
4. Laminating Adhesive: Moisture-resistant thermoplastic adhesive.
5. Mounting Method: Continuous top hanger strips with clips at bottom edge.

B. Vinyl-Fabric-Faced Tackboards: Mildew-resistant, washable, vinyl fabric complying with FS CCC-W-408, Type II, laminated to 1/2-inch fiberboard backing. Provide flame spread rating of 25 or less when tested according to ASTM E 84. Color as selected by Architect from manufacturer's standard colors.

C. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Where size of boards or other conditions exist that require support in addition to the normal trim, provide structural supports or modify trim as indicated.
2. Factory-Applied Trim: Slip-on, with no visible screws.
3. Chalktray: Continuous box-type aluminum chalktray with slanted front and cast aluminum end closures.

4. Integral Map Rail: Furnish map rail at the top of each marker board unit, complete with the following accessories:
 - a. Display Rail: Continuous cork display rail approximately 2 inches wide, as indicated, integral with the map rail.
 - b. End Stops: One end stop at each end of the map rail.
 - c. Map Hooks: 2 map hooks for each 4 feet of map rail or fraction thereof.

D. Fabrication: Laminate porcelain enamel facing sheet and backing sheet to core material with flexible, waterproof adhesive.

E. Assembly: Provide factory-assembled units except where field-assembled units are required. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of the board. Provide vertical joint system between abutting sections of boards. Provide mullion trim at joints between markerboard and tackboard.

F. Finishes: Comply with NAAMM "Metal Finishes Manual."

1. Class II Clear Anodized Finish: AA-M12C22A31.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation: Deliver factory-built units completely assembled in one piece (except for field applied trim). Where dimensions exceed panel size, provide 2 or more pieces of equal length. When overall dimensions require delivery in separate units, prefabricate components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and mounting heights indicated according to manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.

C. Coordinate job-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.02 MARKERBOARD BREAK-IN

A. Clean according to manufacturer's instructions. Break-in markerboards only as recommended by the manufacturer.

END OF SECTION 10 11 00

SECTION 10 12 00 – DISPLAY CASES

PART 1 – GENERAL

1.01 SCOPE OF WORK

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

B. Work includes:

1. Prefabricated aluminum map display cases.
2. Brochure display rack

1.02 SUBMITTALS

A. SD-02 Submit shop drawings, technical data sheets and schedules

1. Submit corner sample of display case in specified color finish for approval

B. SD-08 Contract Closeout Submittals: Maintenance Data: manufacturer's cleaning and maintenance instructions covering both routine and long-term operations.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. B 221, Specifications for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
2. C 1048, Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
3. D1752, Specification for cork sheet, bulletin board

1.04 DELIVERY & STORAGE

A. Ship materials including attachment devices carefully packaged to prevent surface damage. Include shop drawings to ensure correct installation and arrangement of all materials.

1.05 WARRANTY

A. Warrant the work specified herein for 'one year' against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials or workmanship. Warranty shall cover replacement of defective workmanship

and product defects such as but not limited to deterioration of material or finish and difficult operation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Map Display Cases

1. For basis of design, the plans are based on aluminum framed display cases as supplied by Poblocki Signs Co., West Allis, WI.
2. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications. Manufacturer's wishing to submit alternate products shall submit product data sheets and/or specifications.
 - a. Aarco Products Inc.
 - b. Nelson-Harkins Industries
 - c. Apco

B. Wall Mounted Brochure Display Holder

1. For basis of design, the plans are based on all acrylic wall brochure rack as manufactured by BrochureHoldersNow Model CLRB8564.
2. Equivalent products from the following alternate manufactures will be accepted contingent on compliance with the performance requirements as set forth by the base specifications. Manufacturer's wishing to submit alternate products shall submit product data sheets and/or specifications.
 - a. Magazineracks.com
 - b. Braeside Display
 - c. Siegel Display Products

2.02 MATERIALS

A. Map Display Case

1. Aluminum Extrusions: Meeting ASTM B221, alloy 6063-T5
2. Aluminum Panels: Meeting ASTM B209, minimum 0.090" (2.28 mm thick)
3. Glass: ASTM C 1048, fully-tempered, Type 1 clear with minimum 0.25" (6 mm) thickness
4. Tackable Surface: 1/4" thick linoleum grade cork with burlap backing.

B. Wall Mounted Brochure Holder

1. The rack shall include six (6) acrylic pockets, 4-1/8" x 1-1/2" deep and one pocket for 8-1/2" x 11" prints mounted to a 22-3/4"w. x 20" h. acrylic backplate.

2.03 FABRICATION – MAP DISPLAY CASE

A. Map Display Case Cabinet:

1. Description: 6030-T5 extruded aluminum alloy according to ASTM B221; minimum 0.090" thick for window frame panels, and horizontal mullions. Aluminum extrusion nitrided and assembled with concealed corner angles.
2. Cabinet Profile: 2" x 1/2" x 1/8" channel framed aluminum case. Cabinet depth to be 2".
3. Glazing: Minimum 1/4" inch clear tempered glass according to Section 08 80 00.
4. Door Profiles:
 - a. Vestibule 101: Top hinged aluminum frame with continuous anodize aluminum piano hinges and stainless steel pins, hold-open devices, continuous door stops and weather-tight glazing channel suitable for exterior use.
 - b. Public Lobby 102: Side hinged aluminum frame with continuous anodized aluminum piano hinges and stainless steel pins, continuous door stops, and weather-tight glazing channel suitable for exterior use.
5. Locks: All hinged doors shall be equipped with flush mounted cam locks keyed alike.

B. Mounting Method: Surface mounted to concrete masonry wall surfaces behind.

C. Cabinet Background Finish: 1/4" thick linoleum grade colored cork at background over 1/4" luan plywood. Finish and color to be selected by Architect from manufacturer's standard option.

D. Frame Finish: Provide custom color acrylic polyurethane finish on all exposed framing in color to match storefront aluminum framing specified under Section 08 41 00.

2.03 DISPLAY CASE & BROCHURE DISPLAY RACK SCHEDULE (indicated on plans as 'DC')

<u>Mark</u>	<u>Qty</u>	<u>Location</u>	<u>Width x Height</u>	<u>Access Panel</u>
DC-1	1	Vestibule 101	72"w. x 48"h	Top hinged
DC-2	1	Lobby 102	36"w. x 44" h	Side hinged
DC-3	2	Public Lobby 102	22-3/4" x 20" h.	

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install map cases in accordance to shop drawings and manufacturer's recommendations.

3.02 CLEANING, PROTECTION AND REPAIR

A. Clean display units of dirt, dust, and grease after installation.

B. Protect finished installation from damage from work of other trades, such as plastering, gypsum wall board, painting, etc.

END OF SECTION 10 12 00

SECTION 10 14 16 – INTERIOR ROOM SIGNAGE

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all materials, labor and equipment necessary for the installation of interior specialty signs. Applicable provisions of the General Conditions, Supplemental Conditions and General Requirements shall govern the work under this Section.

B. Work includes:

1. Interior room sign plaques
2. Die-cut vinyl letters and graphic

1.02 REFERENCES

A. ADA 101-336, Sections 4.30 – 4.30-5.

1.03 SUBMITTALS

A. Submit the following according to Section 01 33 00 – Submittal Procedures.

1. SD-02 Shop Drawings: Submit drawings indicating dimensions and text layout. Also submit complete schedule of signs.
2. SD-04 Sample:
 - a. Submit full size sign sample in selected colors.
 - b. Sign plaque sample.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:

1. ABC Architectural Signing System
2. Allenite
3. Andco Industries Corp.
4. APCO Graphics, Inc.
5. ASI Sign Systems; Minneapolis, MN
6. Environmental Graphic Systems, Inc.
7. Modulex
8. Mohawk Sign Systems

9. Poblocki & Sons, Milwaukee, WI
10. Spanjer Brothers, Inc.

2.02 MATERIALS

A. Sign Frame: Square corner modular plastic molded frame, ½” deep, prepunched for screw mounting to wall substrate.

B. Room Signs: Sign plaques shall be of solid color plastic equal to Rowmark “Ultramatte” and shall incorporate both raised graphics and Grade 2 Braille. Raised letters and numbers shall be a minimum 1/32” high. Sign panel and graphics shall be as selected from manufacturer’s full range of colors and meet the 70% contrast requirement of ADA 101-336, Section 4.30-5

2.03 SIGN TYPES

A. Room Signs: Room name and number to be identified with 1-1/4” high ‘Helvetica Medium’ raised letters with corresponding Grade 2 Braille text.

1. Size: 8” x 8”

B. Die-Cut Vinyl Lettering And Graphics

1. Vinyl Film: Opaque, non-reflective vinyl film, 0.0035-inch min. thickness, with pressure sensitive adhesive backing, suitable for exterior applications. Colors shall be custom colors compatible with the State of Wisconsin State Patrol and DOT.

2. State Patrol and Department of Transportation Die-Cut Graphics will be provided by WisDOT. Contact Bob Spoerl at (608) 266-8665 for more information. Approximate size: 18 inches x 18 inches.

3. ‘Confined Space’ signage: At door 001A to Scale Tunnel 001, provide vinyl lettering in 2” high lettering indicating ‘CONFINED SPACE’.

2.04 MOUNTING METHOD

A. Signs to be furnished to the jobsite with factory applied double-face tape and prepunched for mechanical attachment (min. 2 screws).

PART 3 – EXECUTION

3.01 INSTALLTION

A. Unless indicated otherwise, room signs shall be installed on the wall adjacent to the latch side of the door or on the nearest adjacent wall where required.

B. All room signs shall be mounted at 60 inches above finished floor to centerline of the sign.

C. Apply die-cut vinyl lettering and graphics where directed by WisDOT personnel.

3.02 ROOM SIGN SCHEDULE

Qty.	Room Location	Room No.	Graphic/Text
1	Public Lobby	102	Room Name and Room Number
1	Women's Toilet	103	Female Pictogram w/ Universal Accessibility Symbol
1	Men's Toilet	104	Male Pictogram w/ Universal Accessibility Symbol
1	Operations	105	Room Name and Room Number
1	Office	107	Officer's Name / Room Number
1	Toilet/Shower Room	108	Male/Female Pictogram w/Universal Accessibility Symbol Room Name
1	Intox	109	Room Name and Room Number
1	Uni-Sex Toilet	110	Male/Female Pictogram w/Universal Accessibility Symbol
1	Janitor	111	Room Name and Room Number
2	Mechanical Room	112	Room Name and Room Number
1	Maintenance Storage	113	Room Name and Room Number
1	Multi-purpose Room	114	Room Name and Room Number
1	Troopers	115	Room Name and Room Number
1	Telecom	116	Room Name and Room Number
3	Classroom	117	Room Name and Room Number
1	Inspections Storage	118	Room Name and Room Number
1	Classroom Storage	119	Room Name and Room Number

END OF SECTION 10 14 16

SECTION 10 14 19 – EXTERIOR BUILDING SIGNAGE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Work includes:
 - 1. Individual cast aluminum lettered sign.
 - 2. Cast aluminum numerals

1.02 SUBMITTALS

- A. Submit the following according to Section 01 33 00 – Submittal Procedures:
 - 1. SD-02 Shop Drawings: Show plans and elevations, sections of typical members, anchors, reinforcement, layout and installation details. Include the following:
 - 2. SD-03 Product Data: Manufacturer's construction details
 - 3. SD-04 Samples for selection of color, pattern and surface texture. Show full range of colors available.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following:
 - 1. Andco Industries Corp.
 - 2. Matthews.
 - 3. Spanjer Brothers, Inc.
 - 4. The Supersine Company.

RETAIN MATERIALS REQUIRED BY SIGN TYPE.

- B. Aluminum Castings: Alloy and temper recommended for casting process used.
- C. Fasteners: Concealed non-corrosive metal fasteners.

D. Anchors and Inserts: Non-ferrous metal or hot-dipped galvanized. Use toothed steel or lead expansion bolts for drilled-in-place anchors. Furnish inserts to be set into concrete or masonry work.

E. Unframed Panel Signs: Fabricate edges mechanically and smoothly finished as follows:

SELECT EDGE COLOR AND EDGE AND CORNER CONDITION FROM OPTIONS BELOW. DELETE EDGE COLOR IF PANEL IS NOT PLASTIC LAMINATE.

1. Corner Condition: Square.

DELETE BELOW IF THERE ARE NO FRAMED SIGNS.

F. Dimensional Letters and Numbers: Form characters by casting with smooth, flat faces, sharp corners, precisely-formed profiles and lines, free from pits, scale, sand holes or other defects. Cast lugs into the back and tap to receive threaded mounting studs.

1. Metal: Aluminum.

SELECT METAL, BORDER STYLE, AND BACKGROUND TEXTURE AND FINISH FROM THE CHOICES BELOW.

G. Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

1. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

RETAIN ONE FINISH BELOW OR REVISE TO SUIT PROJECT.

- a. Finish: AAMA 605.2, Fluoropolymer Coating
- b. Color: Custom color red to match standing seam metal roofing per Section 07 41 00.

PART 3 - EXECUTION

A. Installation: Locate signs where indicated, using mounting methods described. Install level, plumb and at height indicated, with surfaces free from distortion or other defects in appearance.

B. Dimensional Letters and Numbers: Mount characters using fastening methods recommended for wall construction and exposure indicated. Provide template to establish spacing and locate holes for fasteners.

1. Projected Mounting: Mount at distance indicated from wall surface.
- C. Cleaning and Protection: At completion of the installation, clean soiled sign surfaces. Protect from damage until Owner's acceptance.

END OF SECTION 10 14 19

SECTION 10 26 13 – WALL PROTECTION

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Applicable provisions of Division 1 shall govern the work under this Section.
- B. Section includes;
 1. Surface mounted rigid vinyl corner guards.

1.02 SUBMITTALS

- A. SD-02 Provide shop drawings, showing locations, mounting height, sizes, profiles, end caps and attachment method (anchors) for each type guard specified.
- B. SD-04 Samples: Provide 8" long sample in full size profile of each type and color indicated.

1.03 SYSTEM PERFORMANCE

- A. Fire Performance Characteristics: Provide UL Classified corner guards conforming to NFPA Class A fire rating. Surface burning characteristics, as determined by UL-723 (ASTM E-84), shall be flame spread of 10 and smoke development of 350 – 450.
- B. Self-Extinguishing: Provide corner guards with Cci classification, as tested according to the procedures specified in ASTM D-635-74, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position, as referenced in UBC 52-4-1988.
- C. Fungal and Bacterial Resistance: Provide rigid vinyl that does not support fungal or bacterial growth as tested according to ASTM G-21 and ASTM G-22.

1.04 WARRANTY

- A. Guarantee: Provide manufacturers standard five (5) year limited warranty against material and manufacturing defects.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide corner guards from one of the following:
 - 1. Inpro Corporation (IPC), Muskego, WI: 160 Series
 - 2. Construction Specialties
 - 3. Koroseal
 - 4. Arden Architectural Specialties, Inc.

2.02 MATERIALS

- A. Snap-On Corner Guards (90 deg. & wrap around)
 - 1. Vinyl snap-on cover shall be of .080" (2.0 mm.) thickness, 2" x 2" x 48" long high-impact vinyl/acrylic extrusions, designed to absorb shock and resist marks and abrasions under impact. Extrusions shall securely snap over .070 aluminum retainer, mill finish yet retain shock-absorbing movement. Assemblies shall be impact tested according to applicable provisions of ASTM D 256-90b.
 - 2. Chemical and stain resistant according to ASTM D 543.
 - 3. Color shall be integral, with components matched according to SAE J-1545. Total color difference (Delta E) between sample and standard shall be no greater than 1.0 units per Hunter (lab) scale. Colors shall be selected from manufacturer's standard range.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Locate units at exterior corners of gypsum board partition walls where directed by the Architect, using mounting methods as indicated on approved shop drawings for the appropriate substrate.
- B. Installation shall be according to approved shop drawings and manufacturers printed installation instructions.
 - 1. Install level, plumb, with surfaces free of distortion or other defects in appearance.
 - 2. After wall finish is complete, install vinyl covers over aluminum retainer.
 - 3. Clean surfaces at completion per manufacturer's instructions.

END OF SECTION 10 26 13

SECTION 10 28 00 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Work Includes
 - 1. Toilet and shower room accessories
 - 2. Janitor's Closet Accessories

1.02 SUBMITTALS

- A. SD-03 Manufacturer's product data for each toilet accessory item specified, including details of construction relative to materials, dimensions, gages, profiles, method of mounting, specified options, and finishes.
- B. SD-04 Samples: Full-size samples of toilet accessory items when requested for verification of design, operation, and finish requirements, acceptable samples will be returned and may be used in the work.

1.03 REFERENCES

- A. International Building Code
- B. Americans with Disabilities Architectural Guidelines (ADA)

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturers include the following, subject to compliance with the specifications under this section.
 - 1. American Specialties, Inc. (ASI)
 - 2. Bobrick
 - 3. Bradley Corporation.
 - 4. McKinney/Parker.

2.02 MATERIALS

- A. Materials - General: Fabricate toilet accessory items from the following materials and in accordance requirements specified for individual accessory items:

1. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22-gage (.034-inch) minimum thickness, unless otherwise indicated.
2. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16, Castings, ASTM B-30.
3. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 20-gage (.040-inch) minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.
4. Galvanized Steel Sheet: ASTM A 527, G60.
5. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
6. Mirror Glass: Nominal 6.0 mm (0.23 inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating
7. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanize after fabrication.
8. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.
9. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, re-supply, etc. Provide minimum of six (6) keys to Owner's representative and obtain receipt.

B. Toilet Tissue Dispenser:

1. Description: Surface-mounted, twin jumbo-roll, toilet issue dispenser door, cabinet and mounting plate shall be constructed of type-304 stainless steel. Cabinet shall be 20-gauge and equipped with a tumbler lock. Door shall be 18-gauge with a wide viewing slot to reveal toilet tissue supply. Unit shall be fastened through 20-gauge stainless steel mounting plate. Dispensing mechanism shall be constructed of high impact, ABS and shall accommodate two 10" diameter toilet tissue rolls with 3" diameter core; and be equipped with a sliding access panel that exposes one roll at a time. Spindles shall be convertible in the field to dispense 2-1/4" diameter core rolls by removing outer spindles furnished in-place.
2. Qty: 4

C. Stainless Steel Grab Bars: Provide grab bars with wall thickness not less than 18 gage (.050 inch) and as follow:

1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
2. Clearance: 1-1/2 inches clearance between wall surface and inside face of bar.
3. Gripping Surfaces: Manufacturer's standard nonslip texture.
4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.

D. Stainless Steel Channel-Framed Mirror Units

1. Flat Wall Mounted Channel-Framed Mirrors: Fabricate frame with channel shapes of not less than 20 gauge (.040 inch), with square corners carefully mitered to hairline joints and mechanically interlocked. Provide in Type 430 bright polished finish. Mirror to be tempered glass.

2. Qty: 4

E. Stainless Steel Shelves

1. Shelf shall be type-304, 18-gauge (1.2 mm) stainless steel with satin finish. Mounting brackets welded to shelf shall be 16-gauge (1.6 mm) stainless steel. Shelf shall be 5" wide with 3/4" return edges. Front edge shall be hemmed for safe handling.

2. Lengths

- a. Toilet/Shower 108; 16" wide x 5" deep
- b. Inspections 124; 36 inches wide x 6" deep

F. Lavatory-Mounted Soap Dispenser

1. Lavatory-mounted piston and spout assembly with type-304 stainless steel with bright polished finish. Escutcheon shall lock to body with concealed locking mechanism that is opened only with a special key (provided with the dispenser). Spout shall rotate 360 deg. without damage to valve mechanism. Piston, spout, and supply-tube assembly shall be removable from top for filling and maintenance. Valve shall be equipped with plastic cylinder, stainless steel spring, U-packing seal, and duckbills. Translucent, shatter-resistant polyethylene container shall have a capacity of 20-fl oz.

2. Qty: 4

G. Recessed Sanitary Napkin Disposal

1. Recessed sanitary napkin disposal shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Front of sanitary napkin disposal door shall have curved profile with radiused corners and edges. Door shall be self-closing, one-piece, seamless construction; secured to cabinet

with a spring-loaded, full length stainless steel piano-hinge and equipped with two stainless steel cable door swing limiters, two hooks for retaining receptacle, a finger-pull recess at top for easy opening, and an international graphic symbol identifying sanitary napkin disposal.

2. Qty: 1

H. Recessed Combination Towel Dispenser and Waste Receptacle

1. Recessed ADA compliant combination towel dispenser and waste receptacle with removable 10.5 gal. stainless steel waste receptacle. Unit shall be fabricated of 22-gauge type-304 stainless steel with exposed surfaces in satin finish. Warp-free towel cabinet door equipped with piano hinge and secured by tumbler lock. Heavy gauge steel roll towel dispenser for most non-perforated roll towels up to 8" in diameter and 8" wide core sizes from 1-1/2" to 2".

2. Overall Dimensions: 17-1/8"W x 56"H x 8"D

3. Qty: 4

I. Surface-Mounted Soap Dispenser (Inspections 124)

1. Surface mounted soap dispenser shall be type-304 stainless steel with satin finish. Corrosion resistant valve shall dispense commercially marketed all-purpose hand soaps. Valve shall be operable with one hand and with less than 5 pounds of force to comply with barrier-free accessibility guidelines. Door front shall have curved profile with radiused corners and edges of soap dispenser. Container body and back plate shall be epoxy sealed to prevent warping and leakage. Soap dispenser shall have concealed, vandal-resistant mounting. Locked hinged stainless steel lid for top filling shall require special key to open.

J. Surface Mounted Paper Towel Dispenser (Inspections 124)

1. Surface mounted roll-paper-towel dispenser shall be type-304 stainless steel with all welded construction; exposed surfaces shall have satin finish. Door shall be secured to cabinet with a full length stainless steel piano-hinge. Unit shall be equipped with a tumbler lock keyed like other accessories requiring key access. Towel mechanism to accommodate up to 8" wide, 8" diameter, non-perforated paper towel rolls. Leverless pull towel mechanism dispenses one 12" length of towel paper per pull.

K. Mop / Broom Holder (Janitor's Room 111)

1. Mop and broom holder shall be type-304 stainless steel with satin finish. Unit shall be 24" long with three spring-loaded rubber cam holders.

L. Shower Seat

1. One piece stainless steel frame with 'L'-shaped phenolic fold-up shower seat.
 - a. American Specialties (ASI) Model 8206
 - b. Bobrick Model B-5181
 - c. Bradley Model 9569

M. Stainless Steel Robe Hooks

1. Bobrick Model B-233
2. Bradley Model 9314
3. Hook shall be Type-304, 11-gauge stainless steel with satin finish and all welded construction.
4. Locate adjacent to shower stall in Room 108 (Total of 2)

N. Heavy-Duty Stainless Steel Towel Bars

1. Bobrick Model B-205
2. Bradley Model 9065
3. Towel bar shall be type-304 stainless steel with satin finish. Support posts and flanges shall be one-piece, chrome-plated, cast heavy brass with satin finish. Withstands more than 250-lb (113-kg) downward pull when properly installed. Towel bar shall not rotate within support posts.
4. Locate at handicap accessible shower stall in Toilet/Shower Rm 108.

O. Heavy-Duty Shower Curtain Rod

1. Bobrick Model B-6107
2. Bradley Model 953
3. Shower curtain rod shall be type-304, 20-gauge (1.0mm) stainless steel with satin finish, outside diameter of 1" (25mm). Flanges shall be type -304, 20 gauge stainless steel, 2-9/16" x 2-9/16" x 3/4" deep. Unit shall be equipped with concealed mounting brackets.

P. Vinyl Shower Curtains

1. Bobrick Model 204.3
2. Bradley Model 9537
3. Minimum 12 inches wider than opening by 72 inches high.
4. Material: Nylon-reinforced vinyl, minimum 10-oz. or 0.008-inch thick vinyl, with integral antibacterial agent.
5. Color: White
6. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.

Q. Hand Dryers

1. Manufacturer: Excel Dryer Inc.'Xlerator® Model No. XL-SB'.
2. Construction: One piece die-cast zinc alloy cover for surface mounting and automatic time cycle. Motor shall be thermally protected, series commutated, through-flow discharge vacuum motor/blower (5/8 hp / 20,000 rpm) providing air velocity of up to 19,000 lfm. Heating element to be Nichrome wire and mounted inside the blower housing producing an air temperature of up to 135 deg.
3. Control assembly is activated by an infrared optical sensor located next to the air outlet. The dryer shall operate as long as hands are under the air outlet.
4. Qty: 4

2.03 FABRICATION

A. Only a maximum 1-1/2-inch diameter, unobtrusive stamped logo of manufacturer, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by means of either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent accumulation of moisture, as follows:

1. Provide galvanized steel backing sheet, not less than 22 gage (.034 inch) and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror Unit Hangers: Provide system of mounting mirror units that will permit rigid, tamperproof, and theft proof installation, as follows:

1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring special tool to remove.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install toilet accessory units according to manufacturers' printed installations instructions, using fasteners appropriate to substrate as recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly.
- D. Replace damaged or defective items.
- E. Clean and polish all exposed surfaces in strict accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10 28 00

SECTION 10 44 13 – FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Section Includes:
 - 1. Recessed/Semi-recessed fire extinguisher cabinets.
 - 2. UL-listed fire extinguishers bearing UL "Listing Mark" for type, rating, and classification of extinguishers indicated.

1.02 RELATED WORK

- A. Section 04 20 00 – Concrete Unit Masonry : Preparation of openings

1.03 SUBMITTALS

- A. Submit the following according to Section 01 33 00 – Submittal Procedures.
 - 1. SD-02 Shop drawings indicating wall mounting conditions, opening requirements and installation accessories.
 - 2. SD-03 Manufacturer's product data

PART 2 -PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. J.L. Industries.
 - 2. Larsen's Manufacturing Co.
 - 3. Modern Metal Products by Muckle.
 - 4. Profile International Inc.
 - 5. W. F. Lee Corp.

2.02 EQUIPMENT

- A. Fire Extinguishers: Provide fire extinguishers for each extinguisher cabinet and surface wall mount locations indicated. EXTINGUISHERS TO BE FULLY CHARGED, TAGGED AND DATED.
- B. Multipurpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10-lb. nominal capacity, in enameled steel container.
 - 1. Where unit type specified conflicts with other systems or hazard (such as chemicals contained in range hood type systems) provide units as acceptable to regulatory authority.
- C. Mounting Brackets: Provide brackets for extinguishers not located in cabinets.
- D. Fire Extinguisher Cabinets: Provide fire extinguisher cabinets where indicated, of suitable size for housing fire extinguishers of types and capacities indicated. **Provide fire rated cabinets** in 1 hr. and 2 hr. wall construction to maintain fire rating of wall.
 - 1. Recessed: Cabinet box (tub) fully recessed in walls of sufficient depth to suit style of trim indicated.
 - 2. Semi-recessed: Cabinet box (tub) partially recessed in walls of shallow depth.

3. Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.
 4. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - a. Provide 3" rounded edge trim at semi-recessed cabinets.
 - b. Trim Metal: Enameled steel.
 - c. Pull Handle: Manufacturers standard design, or provide flush cup design, to comply with ADA requirements where applicable.
- E. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
1. Enameled Steel: Manufacturers standard finish.
- F. Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" applied to door. Provide lettering to comply with requirements indicated for letter style, color, size, spacing, and location or, if not otherwise indicated, as selected by Architect from manufacturer's standard arrangements.
- G. Identify bracket-mounted extinguishers with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface. Letter size, style, and location as selected by Architect.
- H. Door Style: Manufacturer's standard design.
1. Full-Glass Panel: 1/4-inch-thick clear acrylic.
 - a. Silk screen lettering.
- I. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide flush cup design door pull with friction latch. Provide concealed or continuous-type hinge permitting door to open 180 deg.
- J. Factory Finishing of Fire Extinguisher Cabinet: Comply with NAAMM "Metal Finishes Manual" to provide uniformly finished products. Provide color as indicated, or if not indicated, as selected from manufacturer's standard colors.
1. Baked Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish; chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: As specified below.
 2. Organic Coating: Thermosetting modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with minimum dry film thickness 1.5 mils, medium gloss.
 - a. Color: As selected by Architect from manufacturer's standard colors.

K. Surface Preparation for Steel Fire Extinguisher Cabinets: Solvent clean surfaces in compliance with SSPS-SP 1 to remove dirt, oil, grease, and other contaminants which could impair paint bond. Remove mill scale and rust, if present, from un-coated steel in compliance with SSPC-SP 5 (white metal blast cleaning) or SSPC-SP 8 (pickling).

L. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturers standard 2-coat baked enamel finish, consisting of prime coat and thermosetting topcoat.

M. Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 2.0 mils.

1. Color and Gloss: As selected by Architect from manufacturers standard choices for color and gloss.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

END OF SECTION 10 44 13

SECTION 10 51 00 – METAL LOCKERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1 Specifications, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Single-tier storage lockers
2. Provide fasteners and anchorage devices to install lockers provided under this section.
3. Provide metal filler panels to fill between banks of lockers and adjacent construction.

1.03 SUBMITTALS

A. The following shall be submitted according to Section 01 33 00 - Submittal Procedures:

1. SD-03 Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and furnishes for each type of locker and bench.
2. SD-02 Shop Drawings: Show lockers in detail, method of installation, fillers, trim, base and accessories. Include locker numbering sequence information.
3. SD-04 Samples for verification: Deliver to the jobsite, one full-size Type L-2 locker sample for evaluation. Adherence to the specification is required. Locker submitted must meet specification regardless of manufacturer's standard product. Submit manufacturer's technical data and installation instructions for metal locker units.
4. SD-10 Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 1.

1.04 QUALITY ASSURANCE

A. Uniformity and Single Manufacturer Requirements: Provide each type of metal locker as produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.

B. Installers Qualifications: Lockers to be installed by an experienced agent of the manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Do not deliver metal lockers until building is enclosed and ready for locker installation.

B. Storage and Protection: Protect materials from damage during delivery, handling, storage, and installation.

1.06 WARRANTY

A. Locker manufacturer shall warrant the locker for the lifetime use of the original purchaser from date of shipment. Warranty shall include all defects in material and workmanship, excluding finish, vandalism and improper installation.

PART 2 – PRODUCTS.

2.01 MANUFACTURERS

- A. For basis of design, the plans are based on the DeBourgh Manufacturing Co. ‘Corregidoor Series’.
- B. Subject to compliance with basis of design and requirements of the Contract Documents, other acceptable manufacturers are as follows:
 - 1. Republic Storage Systems
 - 2. List Industries, Inc.

2.02 FABRICATION

- A. Locker Construction
 - 1. Lockers to be welded at seams and joints with exposed welds sanded smooth.
 - 2. No bolts, screws or rivets to be used in assembly of locker units.
 - 3. Ship lockers set-up, ready to be anchored in place according to manufacturer’s instructions.
- B. Body of Lockers
 - 1. Exterior sides, Tops, Bottoms, Tier Dividers and Facia: Constructed of 16 gauge domestic cold rolled sheet steel for maximum durability.
 - 2. Backs: Solid sheet of 18 gauge cold rolled sheet steel welded to frames of sides and intermediate partitions.
 - 3. Shelves and Intermediate Partitions: Constructed of 18 gauge cold rolled sheet steel welded to sides and intermediate partition construction. Shelves provided in lockers 60 inches and taller, located to provide a minimum of 12 inches clearance.
- C. Continuous Door Strike:
 - 1. Tier dividers, tops and bottoms constructed of 18 ga. to provide four-sided, continuous door strike for a secure, sanitary and intrusion-free locker while door is in closed position.

D. Doors

1. Doors are 16 gauge steel, formed outer panel with double bends on both sides and a single bend on top and bottom with 18 gauge steel formed stiffener panel.
2. Door stiffener runs top to bottom on hinge side of door and is securely welded to outer door to form a reinforced channel for additional torque-free strength and sound reduction when closing door. (Inner panel not available on 9 inch wide or box lockers 12 inches high or less).

E. Door Ventilation

1. Louvered doors with six louvers at the top and bottom of the formed door providing 7% ventilation per square inch.
2. Secur-N-Vent doors with three-dimensional vertical vents formed on fronts and backs of door providing 21% ventilation per square inch.

C. Solid doors with 0% ventilation.

F. Latching

1. Sentry III Single Point Latch
 - a. Eleven gauge unbreakable stationary latch welded to the locker frame extending through no more than 1-1/4 inches into locker opening.
 - b. Latch protrudes through flush-mounted, recessed stainless steel cup.
 - c. Capable of accepting padlock or built-in lock.
2. Sentry II Recessed Gravity Latch
 - a. Door containing stainless steel cup recessed into formed door.
 - b. 12 gauge steel finger lift mechanism
 - c. Spring activated nylon slide latching enclosed in steel latch channel allows closing of door while padlock or built-in lock is in position.
 - d. Rubber bumpers riveted to door stops for silent operation.

G. Hinges

1. 16 gauge continuous piano hinge on the right side of the opening.
2. Hinges welded to door and riveted to locker frame.

H. Slope Tops

1. Provide 18 gauge all welded steel top with 25 degree pitch, attached at factory with concealed fasteners. Slope top to be in addition to standard 16 gauge flat top.

I. Closed Base

1. Provide 4 inch high, 14 gauge welded steel base enclosed on all four sides, securely welded to locker bottom.

J. Reinforced Bottom

1. Provide 16 gauge spacer channel welded to locker bottom from front to back for a more secure installation (when closed bases are not used).

K. Filler Panels: Manufacturer's standard fabricated from 18 gauge solid steel finished to match lockers.

L. Finish

1. Complete locker unit to be thoroughly cleaned, phosphatized and sealed.
2. Finish to be baked pure TGIC polyester powder coat with a minimum 2-3 mil thickness.
3. Colors of lockers shall be chosen from manufacturer's 47 standard colors.

2.03 LOCKER ACCESSORIES

A. Hooks

1. Hooks to be heavy-duty forged steel with ball ends and zinc plated Hooks to be heavy-duty forged steel with ball ends and zinc plated.
2. Provide two single wall hooks and one double ceiling hook in each locker opening 20 inches or taller.

B. Numbering

1. Furnish each locker with polished aluminum number plate with etched black numbers.
2. Locate number plate near center of each door
3. Owner to furnish numbering sequence

PART 3 – EXECUTION

3.01 INSTALLATION

A. Wall Installation

1. Securely anchor every locker to wall before use. Installation hardware to be determined based upon wall construction.
2. Tie adjacent locker units by bolting at four points, two at top and two at bottom , using 1/4 inch cadmium plated bolts.

3.02 ADJUSTING

- #### **A. General Requirements:** Upon completion of installation, inspect lockers and adjust for proper door and locking mechanism operation.

3.03 CLEANING

A. General Requirements

1. Clean interior and exposed surfaces, removing debris, dust dirt and foreign substances on exposed surfaces.
2. Touch up scratches and abrasions to match original finish
3. Polish stainless steel and non-ferrous metal surfaces
4. Replace locker units that cannot be restored to factory-finished appearance
5. Use only materials and procedures recommended by locker manufacturer

END OF SECTION 10 51 00

SECTION 10 60 00 – SAFETY NETTING

PART 1 – GENERAL

1.01 SCOPE OF WORK

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

B. Section includes:

1. Safety net system for use in conjunction with the recessed floor inspection trenches in the Inspection Bays.

1.02 RELATED SECTIONS

A. Section 05 50 00 – Metal Fabrications: Steel tube trolley assembly for safety netting attachment.

1.03 SUBMITTALS

A. SD-03 Product data

B. SD-04 Samples: Submit 36” long sample of netting complete with hemmed edge and grommets.

C. SD-02 Shop drawings showing fabrication and erection of safety net system. Include plans, elevations, and large scale sections of typical components. Show anchors, reinforcement, accessories, and installation details.

1.04 REFERENCES

A. Safety net system shall comply with the following regulations:

1. OSHA regulation 1910.22c and 1910.23(a) and General Duty Clause 5(a)(1).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver netting protected in waterproof wrapping and identified as “Inspection Bay Trench Netting”. Store in dry area.

PART 2 – PRODUCTS

2.01 MANUFACTURER

- A. BayNets Safety Systems, Colchester, CT 06415 (Ph: 800-331-0731): BayNets™ ‘BNS38 System’

2.02 MATERIALS

- A. Description: Provide two sets of bi-parting net systems.
- B. Netting Specifications
1. Model # 218-060-06
 2. Style: Raschel Knotless Netting
 3. Fiber: High Tenacity, Polypropylene (HTPP)
 4. Cord Diameter: 3/16 inch (5 mm)
 5. Mesh Size: 2-1/2 inch square opening measured between mesh joints.
 6. Mesh Break: 719 lbf
 7. Dynamic Drop Test: 12,075-ft-lb (ANSI A10.11 test method)
 8. Weight: 0.0528 PSF
 9. Melting Point: 340 deg. F
 10. UV: Extra UV stabilizers added
 11. Color : Black
- C. Netting Components:
1. Provide quick-link connectors for attachment to steel tube trolley rails.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Unpack all items and verify that all net, cable, clamps, turnbuckles, quick links, snap hooks, cable pad eyes and cable lug components have been included.

3.02 MOCK-UP SECTION

- A. Prior to installation of trolley assembly (see Section 05 50 00), provide length of netting necessary testing of operability.

3.03 INSTALLATION

- A. Install netting as indicated on the drawings for a complete and functioning system.

B. Following installation, the entire safety net system should be checked for smooth operation. Adjust as necessary.

3.3 DEMONSTRATION

A. Train Owner's designated personnel on procedures related to net operation, stowage, troubleshooting, servicing, and preventative maintenance.

B. Schedule training with Owner with at least 7-day advance notice.

END OF SECTION 10 60 00

SECTION 10 73 00 – PROTECTIVE COVERINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Manually operated, horizontal protective canvas cover over exterior stair.

1.03 SUBMITTALS

A. Product Data: For each type of material specified.

B. Shop Drawings: Show layouts and details to illustrate assembly and operation. Include the following:

1. Plans, sections, details, and elevations.
2. Drainage details.
3. Anchorage details.
4. Frame details.
5. Accessories for locking.

C. Samples for Initial Selection: For finishes of cover and accessories.

D. Maintenance and Operation Data: For protective cover to include in maintenance manuals.

1.04COORDINATION

A. Coordinate layout and installation of protective cover with adjacent construction, including wall framing, stair construction, railings, and light fixtures.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

1. Custom Cover Design by Baraboo Tent and Awning, Baraboo, WI; Gallagher Tent and Awning, Madison, WI; Northrup Awning Company, Janesville, WI; or approved equal.

2.02 HORIZONTAL PROTECTIVE COVER

A. Manually Operated Cover, General: provide manufacturer's standard mounting accessories, and other components necessary for a complete installation.

1. Drainage: Provide sloped cover assembly for positive drainage, without obstructing occupant's clear view out of the building.

B. Cover: Provide industrial strength, flame retardant vinyl, minimum 17-ounce weight.

1. Available products:
 - a. Ferrari 502, by Astron Company.
 - b. BFT by John Boyle Company.

C. Support Framing: Provide manufacturer's welded aluminum tube frame with steel supports, designed to withstand structural loads anticipated for this application. Support framing design and structural engineering is the responsibility of the fabricator.

D. Surface-Mounted Tracks and Accessories: Units designed and fabricated for surface mounting on masonry and concrete wall substrates, fabricated from clear anodized aluminum extrusions. Tracks and mounting accessories shall permit manual removal of a 15 foot long section of the cover to access the scale tunnel. The remaining portion of the cover may be fixed. When access is not needed, cover shall be secured to prevent the build-up of snow, ice, and water at the stair. Provide a jamb-mounted locking device at the end of the cover to secure it and limit unauthorized access.

PART 3- EXECUTION

3.01 INSTALLATION

A. General: Install protective cover at locations indicated to comply with manufacturer's written instructions.

END OF SECTION 10 73 00

SECTION 10 75 00 – FLAGPOLES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide all materials, accessories and labor necessary for the installation of aluminum flagpoles as shown on the drawings.

1.02 RELATED WORK (BY OTHERS)

A. Section 03 30 00 – Concrete Piers

B. Division 26 - Electrical Systems: Connection to pole mounted light fixtures.

1.03 SUBMITTALS

A. SD-02 Shop Drawings

B. SD-08 Manufacturer's product data and installation instructions.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturer: Provide flagpoles manufactured by one of the following:

1. American Flagpole, Division of Keamy-National.
2. Automatic Flagpole Co., 511 N. Lincoln Avenue, Skokie, Illinois 60153.
3. Concord Industries, Inc.
4. Eder Flag Manufacturing Corp.
5. EMC, Div. of Eder Manufacturing Corp.
6. John Ewing and Co., Inc.
7. Pole-Tech Co. Inc.

2.02 FABRICATION

A. Pole Construction: Fabricate pole in one piece wherever possible. For field joints, use internal splicing sleeve for weather-tight and invisible seams.

1. Flagpole, with or without flag flying, shall resist without permanent deformation a 90-mph wind, have a safety factor of 2.5, and be non-resonant.
2. Pole shall be capable of flying a flag 6'-0" x 10'-0" maximum size.

B. Aluminum Flagpole: Seamless extruded tubing complying with ASTM B 241, alloy 6063-T6, heat-treated and age-hardened, with natural clear 0.7-mil anodized finish, NAAMM-M31C21A41.

1. Pole Height: 30 feet
2. Quantity: 1

C. Cone Taper: Manufacturer's standard seamless, uniform, straight-line tapered section above a cylinder butt section.

D. Base: Provide manufacturer's standard base and anchorage system for ground mounted installation required, including necessary brackets and bracing.

2.03 ACCESSORIES: Manufacturer's standard to suit size and type of pole, and as follows:

A. Finial ball, 8" aluminum w/gold anodized finish.

B. Interior stainless steel halyard, with plastic coated counterweight and sling.

C. Truck assembly, stainless steel, revolving, stainless steel ball bearings, non-fouling, finished to match pole.

D. Hand crank, removable type.

E. Flash collar, spun aluminum to match flagpole finish.

F. Light Fixtures: Bracket mounted 18" long x 6" diameter aluminum cylinders (3 such) designed to accept 150 watt flood lamps for up lighting. Finish to match flagpole.

G. Flags: Provide manufacturer's standard nylon outdoor flags with canvas header and brass grommets.

1. U.S. Flags:
 - a. Size: 5' x 8'
 - b. Qty: 4
2. State of Wisconsin flags
 - a. Size: 4' x 6'
 - b. Qty: 4

PART 3 – EXECUTION

3.01 INSTALLATION: As shown, complete and according to manufacturer's instructions.

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.
- B. Maximum variation from plumb: 1 inch.
- C. Adjust operating devices so halyard and flag operate smoothly.

END OF SECTION 10 75 00

END OF DIVISION 10 – SPECIALTIES

DIVISION 11 – EQUIPMENT

SECTION 11 52 00 – AUDIO-VISUAL EQUIPMENT

PART 1 - GENERAL:

1.01 SCOPE OF WORK

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Work Includes
 - 1. Motorized projection screens
 - 2. Projector mounts
 - 3. Flat screen monitor mounting frame

1.02 RELATED WORK BY OTHERS

- A. Section 09 51 00 – Acoustical Tile Ceilings
- B. Division 26 – Electrical: Electrical supply for electric screens

1.03 SUBMITTALS: In addition to product data, submit the following:

- A. SD-02 Shop drawings showing screen dimensions, fabrication, installation details, and electric wiring details.

1.04 QUALITY ASSURANCE

- A. Motors for electric screens shall be certified by Underwriters Laboratory (UL), Inc. and shall bear UL label.

PART 2 - PRODUCTS

2.01 PROJECTION SCREENS

- A. Motorized Projection Screens
 - 1. Manufacturers
 - a. Da-Lite, Spiceland, IN: Advantage Electrol Model 84299
 - b. Elite Screen VMAX 100XWV2
 - 2. Rollers: Provide rigid metal rollers for operation of electric screens fabricated of either steel or aluminum as determined by manufacturer for screen type and size.

3. Operating Motors: Equip electric screens with UL labeled motors to operate screens.
 - a. Type: 120 V, three wire, permanently lubricated, reversal type designed to be mounted inside roller unless otherwise indicated. Motor amperage to be determined by manufacturer as required for specific application.
 - b. Equip with noise silencer, automatic thermal overload protection, integral gears, capacitor, and electric brake to prevent coasting.
 - c. Limit switches: Pre-set, adjustable switches to automatically stop viewing surface in up or down positions.
4. Projection Screen
 - a. Type: Electrically operated, retractable projection screen with rigid metal roller housing motor.
 - 1) Installation method: Ceiling pocket mounted.
 - 2) Case: Hexagonal with flat back case fabricated from 22 gauge embossed steel with steel end caps designed to receive mounting hardware.
 - 3) Finish: White enamel paint.
 - 4) Permanently attach screen fabric to roller. Provide bottom of screen with metal rod in pocket.
 - 5) Viewing surface: Matte White
 - a. Size: 4:3 ratio, 60" x 80", 100" diagonal
 - b. Provide with black masking borders.
 - 6) Controls
 - a. Electric screen low voltage control: Single motor, low voltage control unit with screw terminal blocks for 115 volt power source input and motor output, input terminals for multiple wall switches, and receivers for radio frequency and infrared transmitters.
 - 7) Housing: 2-1/4 by 4-1/2 by 7 inches galvanized steel enclosure.
 - 8) Wall Switches: Provide low voltage control unit with (2) low voltage, 3 position control switches for UP, DOWN, and STOP functions. Provide switches with box and cover plate. To prevent unauthorized use, equip switches with hinged, key-locked, stainless steel cover plate.

2.02 PROJECTOR MOUNT

A. Manufacturers

1. Chief Model Security Mount #RPAA1
2. Peerless Model PMS Security Mount PSM UNV-W

B. The projector mount shall feature 30 deg. pitch, 30 deg. roll, and 360 deg. yaw. The amount shall be designed for a 50 lb. load capacity.

C. Universal projector mount shall have a quick release slide out bottom tray for easy removal and installation. The projector mount assembly shall be constructed of aluminum and steel finished in black, silver and white for selection by Architect. The main body of the mount shall be 16-gage cold rolled steel which locks into the tilting mechanism and secured to the aluminum ball joint.

2.03 FLAT SCREEN MONITOR MOUNTING FRAME

A. Basis of Design Product: The design is based on the Da-Lite product described below. Subject to compliance with the requirements, provide either the named product or a comparable product by one of the other manufacturers listed in this section:

B. Manufacturer: Da-Lite Screen Co., Warsaw, IN: Model QLP-3642 – Quick Link® Plasma Ceiling Mount .

1. Other Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work included but are not limited to:

- a. Bret Ford.
- b. Lucasey.
- c. Peerless.

C. Equipment

1. Plasma screen mounting frame shall be fabricated mild steel design and consist of a suspended ceiling plate, sliding coupling, Quick Link pivot assembly, adjustable frame assembly, and center support tray.

a. The Quick Link pivot assembly shall be a MIG welded assembly fabricated from 3/8" thick bar, 1-1/2" diameter rod, 5/8" diameter grade 5 bolt, 5/8" nut, 5/8" vibration-resistant lock washer, 1/4" thick washer, and 1-1/2" NPT steel half pipe coupler. It shall connect to the adjustable frame assembly and allow it to swivel 360° and tilt forward 0° through 30°.

b. The adjustable frame assembly shall consist of one 11-gauge hanger and five formed interconnecting 14-gauge channels.

c. The 14-gauge center support tray shall have a minimum 1/2" formed lip to restrict monitor travel and be perforated for attaching the TV/monitor.

d. Mount packages shall safely hold a 36" to 42" diagonal screen TV/monitor. Mount assemblies shall have a commercial powder coat black finish whereas the suspended ceiling plate shall have a powder coat white finish.

2.04 ACCESSORIES

A. Installation hardware: Provide threaded rods, Unistrut™ channels, attachment hardware, fasteners, and other components of type, size, and spacing recommended by manufacturer for complete, functional, secure installation of suspended monitor mounting frame.

1. Suspended Ceiling Plate: 14-gauge formed plate shaped and sized to replace a nominal 2' x 2' suspended ceiling tile. Furnish plate with UniProvide to topside .
2. Ceiling Mounting Pipes: 1-1/2" NPT pipe x length indicated on the drawings.
3. Coupling Plate: Provide sliding pipe coupler (Da-Lite Model CM-USC) for attachment of pipe to ceiling plate.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Projection Screen

1. General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.
2. Install front projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.

B. Projector Mount

1. Coordinate anchoring requirements with carpenter contractor. Provide concealed backing as necessary for suspending projector mount from roof framing trusses.
2. Coordinate electrical connections with Electrical Contractor.
3. Install projector mount according to manufacturer.

C. Flat Screen Monitor Mounting Bracket

1. Mount Unistrut channels to underside of steel roof joists.
2. Position threaded rods and brace as indicated on the drawings.

3. Install ceiling plate in ceiling grid.
4. Attach monitor mount and pivot assembly per manufacturer's installation guidelines.

3.02 TESTING

- A. Test electrically operated units to verify that screen, controls, limit switches, closure, and other operating components are in optimum functioning condition.

END OF SECTION 11 52 00

SECTION 11 72 53 – MEDICAL TREATMENT EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Work Includes
 1. Defibrillator equipment

1.02 RELATED WORK BY OTHERS

- A. Division 26 – Electrical: Electrical supply

1.03 SUBMITTALS

- A. Submit product literature and specifications.

PART 2 - PRODUCTS

2.01 DEFIBRILLATOR EQUIPMENT

- A. Manufacturer (No substitutions): Medtronic Physio Control LifePak 9P

2.02 DESCRIPTION

- A. Defibrillator to have EASY 1-2-3 operation with built-in noninvasive pacing and user-friendly display.

B. Features:

1. High and low energy select displays.
2. Annotating recorder that prints out time. Date, leads, gain, and CODE SUMMARY critical event, which recaps critical events from the moment of “power on”.
3. Defibrillator adapter used with auxiliary paddles for “hands-free” defibrillation.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount defibrillator as recommended by manufacturer.

END OF SECTION 11 72 53

END OF DIVISION 11– EQUIPMENT

DIVISION 12 – FURNISHINGS

SECTION 12 20 00 – WINDOW TREATMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish and install window treatment at all rooms identified on the drawings, including all track systems, recessed roller shade pocket headbox assembly and mounting hardware necessary for a complete installation.

B. Window treatment will include the following:

1. Horizontal louver window blinds
2. Rolling fabric room darkening solar shades (manual)
3. Roller tinted film shades (manual)

1.02 REFERENCES

A. ASTM E84 – Surface Burning Characteristics of Building Materials

1.03 SUBMITTALS

A. SD-04 Samples two 12” long samples, illustrating color and pattern for each horizontal blind material specified.

B. SD-02 Shop drawings showing details of components necessary for a complete installation.

C. SD-08 Manufacturer’s Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. SD-08 Maintenance Data: Include maintenance procedures. Recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.04 WARRANTY

A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the window blind manufacturer are unacceptable.

B. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds (WT-1)

1. Graber
2. Hunter Douglas
3. Levolor Contract
4. Springs Window Fashions Division; Bali
5. Verosol USA, Inc.

B. Rolling Fabric Solar Shades (WT-2)

1. BTX Window Automation, Inc.
2. Draper Shade & Screen Co., Inc.
3. MechoShade Systems, Inc.

C. Rolling Tinted Film Solar Shades (WT-3)

1. Hunter Douglas Window Fashions
2. Nyson Shading Systems Ltd.
3. Sol-R-Veil

2.02 MATERIALS – HORIZONTAL LOUVER BLINDS: WT-1 (See drawing A904)

A. Fabrication

1. Louver Slats: Aluminum, alloy and temper recommended by manufacturer for type of use and finish indicated with crowned profile and radiused corners.
 - a. Slat Width: 1 inch (25 mm)
 - b. Slat Spacing: Not less than every 20 mm for 15.2 slats or more per foot (20 mm).
 - c. Nominal Slat Thickness: Not less than 0.008 inch (0.20 mm).
 - d. Slat Finish: Equal to Hunter Douglas D1-127 'Linen Flirt'. Slats to have ionized coating with antistatic, dust-repellent, baked polyester finish.
2. Headrail/Valance: Decorative, integrated headrail, valance not requiring a separate valance or end brackets for finished appearance; formed steel or extruded aluminum; log edges returned or rolled; fully enclosing operating mechanism on three sides and ends; capacity for one blind per headrail, unless otherwise indicated.
 - a. Finish Color Characteristics: Match color, texture, pattern, and gloss of louver slats.

3. Bottom Rail: Formed-steel or extruded-aluminum tube, sealed with plastic or metal capped ends top contoured to match crown shape or louver slat, bottom contoured for minimizing light gaps; with enclosed and protected ladders and tapes to prevent their contact with sill.
4. Tilt Control Method: Consisting of enclosed worm gear mechanism, slip clutch or detachable wand preventing over-rotation, and linkage rod, for the following operation:
 - a. Tilt Operation: Manual with clear plastic wand.
 - b. Tilt Two-direction, positive stop or lock-out limited at an angle of 60 degrees from zero-degree horizontal, both directions.
5. Lift Operation: Manual, top-locking cord lock; locks pull cord to stop blind in either fully opened or fully closed position only and is equipped with a ring pull not more than 4 inches long.
6. Ladders: Evenly spaced to prevent long-term louver sag.
7. Mounting: End mounting permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

2.03 MATERIALS – ROLLING SOLAR SHADES: WT-2 (See drawing A904)

A. Fabrication

1. Fabric: Vinyl-coated polyester yarns consisting of 25% polyester, 75% PVC on polyester, Greenguard Certified based on MechoShade *Thermoveil*® Open Basket Weave 2100 Series.
 - a. Percent Opening: 10 %
 - b. Solar Shade Color: Based on Mechoshade #2104 Black/Brown
 - c. Shades must be the sizes as shown on the drawings. Splitting of shades is not allowed.

B. Roller: Fabricated from extruded aluminum or steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade size. Provide with roller idler assembly of molded nylon and zinc-plated steel pin. Sliding pin to allow easy installation and removal of roller.

C. Hem Bar: Provide manufacturer's standard aluminum extrusion enclosed in a fabric hem pocket with heat-welded seams and ends.

D. Recessed Pocket Headbox : Fabrication from manufacturer's standard extruded aluminum sections with endcaps and integral ceiling angled leg for support of abutting acoustical ceiling tile.

1. Exposed Aluminum Finish: Baked enamel paint finish available in manufacturer's standard range of colors.
 2. Attachment Hardware: Window Treatment Contractor shall provide wall brackets and mounting hardware as necessary to secure roller assembly.
- E. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb.
- F. Lift Operation: Manual, top-locking cord lock.

2.04 MATERIALS – ROLLER TINTED FILM SHADES; WT-3 (See drawing A904)

- A. Shade Material (Based on MechoShade *MirroFilm*™ 0600 Series)
1. PVC-free, light filtering, and heat insulating of tinted polyester film with a deposit of pure aluminum in the core.
 2. Color: 0606 Smoke/Silver-Smoke
- B. Hembars: Provide extruded aluminum oval or rectangular shaped hembar with matching end caps, pre-weighted, to maintain bottom of shade fabric straight and flat. Aluminum extrusions to be finished to match color of curtainwall framing.
- C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets with manufacturer's standard method for attaching shade material.
- D. Recessed Pocket Headbox : Fabrication from manufacturer's standard extruded aluminum sections with endcaps and integral ceiling angled leg for support of abutting acoustical ceiling tile.
1. Exposed Aluminum Finish: Baked enamel paint finish available in manufacturer's standard range of colors.
 2. Attachment Hardware: Window Treatment Contractor shall provide wall brackets and mounting hardware as necessary to secure roller assembly.
- E. Lift Operation: Manual, top-locking cord lock.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Complete field measurements prior to fabrication

3.02 INSTALLATION

- A. Mount track assembly as recommended by manufacturer and install blinds

END OF SECTION 12 20 00

SECTION 12 48 16 – FLOOR GRIDS & FLOOR MATS

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. Section Includes
 - 1. Aluminum framed floor grid and mat
 - 2. Anti-fatigue mats

1.02 RELATED SECTIONS

- A. Section 03 30 00 – Concrete: Recessed Floor Slab

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.04 SUBMITTALS

- A. SD-03 Submit manufacturer's specifications and technical data, including Material Safety Data Sheets, installation instructions, as required, and catalog cuts and templates where required to explain construction and to provide for incorporation into the project.

B. SD-02 Submit shop drawings showing layout and types of mats and floor grids and frames; full-scale sections of typical installations; anchors and accessories. Shop drawings submittal shall be coordinated with concrete work shop drawings showing oversized recess for deferred installation of frame.

C. SD-04 Samples:

1. Floor grid
2. Anti-fatigue mat

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver floor grid system to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.

B. Store components in original containers in a clean, dry location.

1.06 WARRANTY

A. Submit manufacturer's warranty that materials furnished will perform as specified for a period of not less than two (2) years for floor grids and not less than three (3) years for floor mats when installed according to manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Floor Grids (F. GRID)

1. Balco, Inc. 'FGLP Series'
2. Mats Inc. 'Grate Mat XT'
3. Pawling Corp.

A. Anti-Fatigue Mats (MAT)

1. Mats Inc. 'Cushion Eze'
2. R C Musson Rubber Company: 'Sof-spun Vinyl Sponge Mats'
3. 3M™ Anti-Fatigue Mats

2.02 MATERIALS – FLOOR GRIDS

A. Floor Grid Systems:

1. Tread rails: ASTM B221, alloy 6005-T6
2. Continuous vinyl hinges: Flexible PVC
3. Frames: Aluminum, ASTM B221, alloy 6063-T5

4. Angle Frames: Aluminum, ASTM B221, alloy 6063-T5
 5. Locking Bars: Aluminum, ASTM B221, alloy 6063-T5
- B. Inserts: Two (2) part epoxy combined with aluminum oxide grit.
1. Color: Balco 'ABRV Canyon Tan' or as selected from approved alternate manufacturers.
- C. Fasteners, accessories and other materials indicated as provided by the manufacturer on the manufacturer's details and in the manufacturer's installation instructions and required for complete installation to manufacturer's instructions.

2.03 MATERIALS – ANTI-FATIGUE MATS

- A. 3/8" thick closed cell sponge w/ vinyl edge perimeter.
- B. Surface: Manufacturer's standard embossed pebble surface
- C. Size: 25' - 4" x 48" (cut from roll goods)
- D. Color: Selected by Architect from manufacturer's standard range of colors.

2.04 FABRICATION – FLOOR GRIDS

- A. Fabricate floor grid assemblies as detailed.
1. Fabricate grid custom cut sections as required.
 2. Fabricate floor grids as a series of grid tread bars spaced at 1-1/2 inches O.C. nominal.
 3. Tread surfaces shall have abrasive inserts locked into extruded aluminum tread rails.
 4. Provide necessary and related parts, devices, anchors and other items required for proper installation.
- B. Provide components single size where possible; minimize site splicing.
- Provide minimum number of pieces possible for frames that exceed maximum length. Provide frames with hairline joints, equally spaced, complete with corner pin, splice plates and installation anchors.
 - Frame, aluminum pan and I-beams shall be shop fabricated as an assembled unit for installation in the field.
- B. Shop assemble components and package with anchors and fittings.

2.04 FINISHES – FLOOR GRIDS

A. Aluminum

1. Tread rails, “U” channels; Clear Anodized
2. Embedded Frames: Shop coating of clear acrylic.

2.05 FLOOR GRID SCHEDULE

<u>Room</u>	<u>Size (Nominal Dimensions)</u>
Vestibule 101	26’-0” long x 5’-0” wide
Vestibule 122	7’ – 0” long x 4- 0” wide
Operations 106	4’ – 0” long x 5- 0” wide

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Contractor shall verify that field measurements and recessed dimensions are as shown on shop drawings prior to releasing materials for fabrication by the manufacturer.
- B. Installer shall examine conditions under which work is to be performed and shall notify the contractor in writing of unsatisfactory conditions. Installer shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 INSTALLATION

- A. Install floor grid system according to the governing regulations, the industry standards applicable to the work and the manufacturer’s written installation instructions.
- B. Work shall be aligned plumb, level, and where required, flush with adjacent surfaces.
- C. Anchors shall be spaced at 24 inches O.C.

3.03 ADJUSTING AND PROTECTION

- A. Inspect system components for proper fit. Adjust, repair or replace components not conforming to requirements. Repair or replacement of an individual unit shall be as approved by the Architect.
- B. Advise the contractor of procedures required to protect the finished work from damage during the remainder of the construction period.
- C. Finished units shall be without damage. Units damaged during shipping or construction shall be repaired by the contractor at the expense of the party damaging the material, according to the contract requirements.

D. Protect installation from damage by work of other Sections. After installation of frame, install temporary filler of plywood in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of Substantial Completion.

END OF SECTION 12 48 16

SECTION 12 50 00 – FURNITURE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section specifies general requirements for furniture as noted on the Furniture Schedule.

1. Tables
2. Chairs
3. File Cabinets
4. Chairs
5. Desks
6. Movable Stairs

1.03 SUBMITTALS

A. Submit in compliance with Section 01 33 00 – Submittal Procedures.

B. SD-07 Installer Certification: Submit for architect's approval, prior to review of product data, samples, and shop drawings, the following: A certificate of license or letter from manufacturer stating full approval of installer (furnishings contractor). Contractors unable to obtain the above-specified credentials will not be considered acceptable installers

C. SD-03 Product Data: Submit specifications, assembly, and installation instructions and general recommendations from manufacturers for each type of furnishing required. Include data substantiating that materials comply with requirements.

D. SD-04 Samples for Initial Selection: Manufacturer's color charts or sections showing the full range of finishes, colors, textures, and patterns available for each exposed material.

E. SD-08 Maintenance Data: Submit manufacturer's printed instructions for maintenance and installation. Include precautions against materials and methods that may be detrimental to finishes and performance.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer (material producer) with not less than five (5) years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Installer Qualifications: Contractor with not less than five (5) years of successful experience in installation of furnishing similar to those required for this project.

C. Source Limitations: Obtain each type of furnishing required, including accessories and mounting components, through one source from a single manufacturer.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install seating until space is enclosed and weatherproof; wet work in space is complete and dry; finishes, including painting, are complete; and work above ceilings is complete. Do not install seating until ambient temperature and humidity conditions are continuously maintained at the levels anticipated for final occupancy.

B. Field Measurements: Verify seating layout by field measurements before seating fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Review delivery and storage conditions before and during installation. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements. Review temporary protection requirements for furnishings during and after installation.

1.06 PRODUCT STORAGE, DELIVERY AND HANDLING

A. All shipping, storage and delivery costs for equipment furnished by the furnishings supplier.

B. Do not deliver furnishings until authorized by the General Building Contractor. Verify storage areas with the prior to delivery. Verify delivery route and building access prior to fabrication or installation.

C. Furnishings shall be wrapped and crated at the factory and shall be delivered in undamaged condition. The General Building Contractor shall be responsible for loss or damage to equipment until final inspection and acceptance by the Owner. Store all furnishings and materials in such a manner as to prevent damaged to moisture, foreign material and impact.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. For basis of design, the furniture items listed below are based on products manufactured by KI, Green Bay, WI.

B. Equivalent products from the listed alternate manufactures will be accepted contingent on compliance with the base specifications associated with the selected furnishing item. Manufacturer's wishing to submit alternate products shall submit product data sheets and/or specifications for approved alternates.

C. All products must have a minimum of a (10) year warranty and the providing manufacturer will cover all repair costs associated during this warranty period.

2.02 FURNISHINGS SCHEDULE

A. Training Tables **F-1**

1. Manufacturers: KI "Datalink" Training Table - 24"D x 72"W x 29"H w/PowerUp Left & Right Edge Locations, Folding Leg, Hinged Beam, & Urethane Edge.

a. Model: DL247229-ME-NP

b. Quantity: 16

2. Description:

a. Worksurface - Training table work surface tops to be 1-1/4" thick with a .042" thick high-pressure laminate surface, urethane edging and .045" thick backer over a 45 lb/CF density particle board core.

Connect modules will be available along the back edge of the work surface away from the user in either the right or left-hand corners or both locations. Two nylon carrying handles are built in to the bottom of the worksurface along the front edge. The folded legs are held in place by two retractable nylon leg locks that are recessed into the bottom of the worksurface. The grommet shall be 6-3/4" x 3-3/8" (o.d.) ABS grommet with a flip-up receding door. The grommet shall be identical in size to the Connect modules to allow for retrofitting.

b. Folding Leg Mechanism - Assemblies come attached to the completed table, no assembly required. The table unfolds by releasing the legs from the leg locks and raising the legs.

c. Wire Management - Tables to include hinged wire management trough for concealing standard loft, 15 amp, three prong plug with circuit breaker. 'Power Up' devices to be manually opened and closed with two-sided, bi-colored 'T'-connector for attachment to cord, which terminates with a latched connection. The cord may be either the in feed or a jumper. All jumper plugs and 'T'-connections are keyed and color-coded.

d. The PowerUp - Module shall be 7" long x 3-1/2" wide x 2-1/2" high and fit securely into a 6-1/4" x 3" cutout but still allow removal without tools. The module shall be constructed of polycarbonate with a textured finish, meeting UL-VO minimum requirements. The module shall have two receptacles rated at 15 Amps/125 Volts and two locations for data connectors. Snap-in data plates hold data connectors and allow the standard module to accommodate most manufacturers. The data connectors are not supplied with the module and shall be purchased by the customer. The module shall have a dampened spring-loaded mechanism to allow the unit to open for use and shall be able to close when not in use. The power receptacles shall open above the plane of the worksurface to avoid accidental spills into the receptacle. The data jacks shall remain stationary to avoid excess wear and tear on the wire connections and promote good transmission of communication data. The module shall come standard with 180" cord with a 3-prong plug.

B. Tables: F-2

1. Manufacturer: KI "Barron" Table - 60"W x 30"D x 29"H, 74P Edge, T-Base, HPL Surface & Powder-coated Base.

2. Model: B255F-74P

3. Quantity: 2

4. Description:

a. Pedestal Base Table - This system employs 14-gauge, 1 3/4" O.D. tubular 1010 steel components in fixed, folding or flip-top models. Barron includes T, TT, X, LX and cantilevered 'T' base combinations. LX series is furnished with 3" O.D. seamless tubular steel column. All ends capped with finished steel plugs brazed in place, ground and polished smooth. End cap joints and leg to stringer joints will be silver brazed with 505 alloy (50% silver and 50% other, including 2% nickel added for a strong joint). Adjustable glides are secured to the legs via steel inserts in foot tube (riv-nuts) which provide a 5/16" threaded hole for the glide.

b. Fixed Base - Fixed table column welded to an 8" x 8" square, 12-gauge sheet steel plate with formed ribs for added strength and 4 mounting screws (5/16" hole for a #14 screw). LX base will be welded to an 8" x 8", 1/4" sheet steel plate.

c. Surface - Tops consist of a 1 1/8" thick high-density particleboard core with a .020" high-pressure laminate top and .020" phenolic backing sheet. Tops are pre-drilled. Vinyl "T" molding will be press fit into particle board core. KI tables can hold a maximum of 1.5 lbs for each inch of perimeter evenly distributed over the top.

d. Brazing - Entails the joining of two metal parts by melting an alloy into the joint between the two parts. By heating the joint and melting the alloy through contact with the joint, the alloy will be pulled into the joint through a phenomenon called capillary action. This will create a strong bond between the two parts. The joint is actually stronger than the parent material. Plus, joint appearance will be clean and smooth.

C. Filing – Pedestal: **F-3**

1. Manufacturer: KI “700 Series” Pedestal – File/File Freestanding Pedestal File, 2 Drawer, Letter Size, Lockable & 24"D x 15"W x 29"H.

2. Model: S7P/1524FFF

3. Quantity: 22

4. Description:

a. Shell - All pedestals are closed top design. Free standing and mobile pedestals have a continuous top surface. The top is 20-gauge cold-rolled steel (C.R.S.) with 1 1/8" flanges on all edges, with the front edge having an additional return formation to further add strength. The front 1 1/8" flange has a pre-punched hole approximately 2" from the right corner for the controlling lock. The pedestal body is a one-piece wrap-around design using 20-gauge C.R.S. The top edge is offset formed to accept the 1 1/8" flange of the top and to provide a flush detail. The bottom edge is flanged inward 1/8" to provide a surface to spot weld the back bottom reinforcement (when required) and the front upright box frame. The vertical front edges are channel-formed to provide additional strength and safety. The front upright assembly is a spot welded "box-frame" design, in which both front upright members are securely welded to the top reinforcement and bottom reinforcement to provide a strong, square frame. All components of the assembly are fabricated from 20-gauge C.R.S. Each corner or joint has a unique bracing design punched from the parent material. This design provides for double thickness at each corner for maximum strength. The frame assembly is inserted inside the pedestal and spot welded along the four vertical flanges of the uprights and at the bottom flange. The two back uprights are formed from 22-gauge C.R.S. and are double offset shaped. The front and back uprights are punched with square holes to allow the drawer suspensions to "clip" into the uprights. Each free standing and work surface supporting pedestal is equipped with one 16-gauge back bottom reinforcement and a 16-gauge front glide support with threaded weld nuts to accept four adjustable glides. Mobile pedestals are fitted with two swivel and two braking twin wheel casters which are threaded into the bottom reinforcement and glide support. Pedestals without counterbalance weights are equipped with fifth wheels.

b. Drawers - Drawers are available in 3" (pencil), 6" (box) and 12" (file) heights. Fronts are screw-mounted to the drawer body. The outer front is fabricated from 22-gauge C.R.S. with a 1 1/4" x 12" handle recess and flanged on all four sides. The inner front liner is also fabricated from 22-gauge C.R.S. with extruded holes to accept screws and flanges on all four sides. The front and liner are spot welded together to create a 3/4" thick rigid drawer front. The drawer body is formed from 22-gauge pre-painted C.R.S. The upper edges are formed to provide a smooth edge as well as providing full length reinforcements. The box and file drawers are designed with four rows of slots to accept an adjustable divider. The drawer slides are bossed and pre-punched to accept the suspensions. The drawer

back is 22-gauge pre-painted C.R.S. with a 30° form along the top edge and is mechanically clenched to the body. Each file drawer has a "Z" shaped component welded to the front liner to function as a support for one end of the hanging folders. The other end of a hanging folder is supported by locating the full-height divider in the appropriate slots.

d. Drawer Pulls - Drawers can be equipped with the following drawer pulls: classic, aluminum bow tie, nickel bow tie, aluminum metric, retro nickel and arc nickel. Drawer handles are curved metal flanges located in the middle of the drawer at the top of each front. Handles are painted black or to match the unit.

e. Suspensions - The pencil and box drawers operate on a ¾ travel, 2-section slide assembly constructed from precision roll-formed sections, on hardened steel ball-bearings. Slides are zinc plated. The file drawers operate on full extension, 3-section slide assemblies. The sections are precision roll-formed steel and roll on hardened steel ball-bearings.

D. Filing – Vertical: **F-4**

1. Manufacturer: KI “700 Series” Vertical File - Vertical File, 4-Dawer, Letter Size, Lockable, & 27 5/8”D x 15W x 48”H.

2. Model: S7V/15304DFB

3. Quantity: 1

4. Description:

a. Shell - All verticals are closed top design. The top is 20-gauge cold-rolled steel (C.R.S.) with 1 1/8" flanges on all edges, with the front edge having an additional return formation to further add strength. The front 1 1/8" flange has a pre-punched hole approximately 2" from the right corner for the controlling lock. The pedestal body is a one-piece wrap-around design using 20-gauge C.R.S. The top edge is offset formed to accept the 1 1/8" flange of the top and to provide a flush detail. The bottom edge is flanged inward 1/8" to provide a surface to spot weld the back bottom reinforcement (when required) and the front upright box frame. The vertical front edges are channel-formed to provide additional strength and safety. The front upright assembly is a spot welded "box-frame" design, in which both front upright members are securely welded to the top reinforcement and bottom reinforcement to provide a strong, square frame. All components of the assembly are fabricated from 20-gauge C.R.S. Each corner or joint has a unique bracing design punched from the parent material. This design provides for double thickness at each corner for maximum strength. The frame assembly is inserted inside the pedestal and spot welded along the four vertical flanges of the uprights and at the bottom flange. The two back uprights are formed from 22-gauge C.R.S. and are double offset shaped. The front and back uprights are punched with square holes to allow the drawer suspensions to "clip" into the uprights. Each free standing and work surface supporting pedestal is equipped with one 16-gauge back bottom reinforcement and a 16-gauge front glide support with threaded weld nuts to accept

four adjustable glides. Mobile pedestals are fitted with two swivel and two braking twin wheel casters which are threaded into the bottom reinforcement and glide support. Pedestals without counterbalance weights are equipped with fifth wheels.

b. Drawers - Drawers are available in 3" (pencil), 6" (box) and 12" (file) heights. Fronts are screw-mounted to the drawer body. The outer front is fabricated from 22-gauge C.R.S. with a 1 1/4" x 12" handle recess and flanged on all four sides. The inner front liner is also fabricated from 22-gauge C.R.S. with extruded holes to accept screws and flanges on all four sides. The front and liner are spot welded together to create a 3/4" thick rigid drawer front. The drawer body is formed from 22-gauge pre-painted C.R.S. The upper edges are formed to provide a smooth edge as well as providing full length reinforcements. The box and file drawers are designed with four rows of slots to accept an adjustable divider. The drawer slides are bossed and pre-punched to accept the suspensions. The drawer back is 22-gauge pre-painted C.R.S. with a 30° form along the top edge and is mechanically clenched to the body. Each file drawer has a "Z" shaped component welded to the front liner to function as a support for one end of the hanging folders. The other end of a hanging folder is supported by locating the full-height divider in the appropriate slots.

c. Drawer Pulls - Drawers can be equipped with the following drawer pulls: classic, aluminum bow tie, nickel bow tie, aluminum metric, retro nickel and arc nickel. Drawer handles are curved metal flanges located in the middle of the drawer at the top of each front. Handles are painted black or to match the unit.

d. Suspensions - The pencil and box drawers operate on a 3/4 travel, 2-section slide assembly constructed from precision roll-formed sections, on hardened steel ball-bearings. Slides are zinc plated. The file drawers operate on full extension, 3-section slide assemblies. The sections are precision roll-formed steel and roll on hardened steel ball-bearings.

E. Task Chair: **F-5**

1. Manufacturer: KI "Impress Ultra" Task Chair - Adjustable Mesh Mid-Back, Upholstered Memory Foam Seat w/Pallas Grade 1 Fabric, 360 Degree Pivot Arm w/Width & Height Adjustment.

2. Model: KI75/JR30

3. Quantity: 4

4. Description:

a. Mechanism – Stamped steel dual housing forms a sturdy cradle for the seat. There are two control levers. One lever actuates the pneumatic cylinder with infinite selection within the range. One lever locks the chair in one of 3 positions or actuates the free-floating mode. The Synchronized 2:1 free floating mode has adjustments of 8 degrees on seat and 16 degrees on back.

b. Backrest – Nylon with fiberglass reinforced frame. Back mesh material is polyethylene elastomeric with polyester.

- c. Back Height – An easy to operate mechanism is installed on the back board for adjusting back height.
- d. Seat – Constructed of a ½” thick, saddle shape plywood with 2.5” molded foam and upholstered with fabric. The entire seat assembly is mounted to the mechanism by 4 screws. Double layer of foam. Molded memory foam is layered over molded, high-resiliency foam. Seat only.
- e. Base – 25” diameter, five blade reinforced black nylon base.
- f. Casters – The double 55mm diameter black wheels are molded of high-impact thermoplastic and are housed in a high-impact frame. Carpet or hard floor casters are available.
- g. Arm Cap – Molded Urethane pivots 360° and locks in place. Arm cap is black. 3" of height adjustment and 3" of total width adjustment
- h. Fabric – Pallas Grade 1

F. Task Chair: **F-6**

- 1. Manufacturer: KI “Impress Ultra” Stool - Adjustable Mesh Mid-Back, Upholstered Memory Foam Seat w/Pallas Grade 1 Fabric, 360 Degree Pivot Arm w/Width & Height Adjustment & Foot Rest Ring.
- 2. Model: KI74/JR30
- 3. Quantity: 9
- 4. Description:
 - a. Mechanism – Stamped steel dual housing forms a sturdy cradle for the seat. There are two control levers. One lever actuates the pneumatic cylinder with infinite selection within the range. One lever locks the chair in one of 3 positions or actuates the free-floating mode. The Synchronized 2:1 free floating mode has adjustments of 8 degrees on seat and 16 degrees on back.
 - b. Backrest – Nylon with fiberglass reinforced frame. Back mesh material is polyethylene elastomeric with polyester.
 - c. Back Height – An easy to operate mechanism is installed on the back board for adjusting back height.
 - d. Seat – Constructed of a ½” thick, saddle shape plywood with 2.5” molded foam and upholstered with fabric. The entire seat assembly is mounted to the mechanism by 4 screws. Double layer of foam. Molded memory foam is layered over molded, high-resiliency foam. Seat only.
 - e. Base – 25” diameter, five blade reinforced black nylon base.
 - f. Casters – The double 55mm diameter black wheels are molded of high-impact thermoplastic and are housed in a high-impact frame. Carpet or hard floor casters are available.
 - g. Arm Cap – Molded Urethane pivots 360° and locks in place. Arm cap is black. 3" of height adjustment and 3" of total width adjustment.

G. Guest Chair: **F-7, F-7A and F-7B**

1. Manufacturer: KI "Grazie" - Stackable, 4-Leg w/Casters, Armless, Fully Upholstered Seat & Back w/Pallas Grade 1 Fabric. Perfect Pivot Back Mechanism.
2. Model: GLNAUBC (Qty:32), GLNAUB (Qty: 14) and GSNAP (Qty: 1)
3. Total Quantity: 47
4. Description:
 - a. Seat - Urethane foam is attached to an injection-molded polypropylene liner board, then upholstered using a draw-string process. Seat foam is molded nominal 1" thickness, and back foam is nominal 1/2" thickness. The flush-head fasteners that attach the back pad are color-matched to the polypropylene.
 - b. Legs - Made from 7/8" OD x 13-gauge tubular steel. A double ring of 7/16" diameter steel wire forms the crossmember. The fixed backrest mechanism structure is formed of 1/2" diameter steel wire. All joints are welded.
 - c. Frames - Finished in either baked-on electrostatically-applied 30 degree gloss epoxy powder-coating, or bright nickel-chrome plating.
 - d. Backrest Articulation Mechanism - Two outer backrest supports formed from 1" diameter tubular steel are inserted into sockets molded into the backrest, and secured with screws. The backrest assembly moves over molded thermoplastic slide bushings and is supported by steel coil springs. This mechanism allows the backrest to move through 15 degrees of movement, about an axis of rotation that is through the hips of the occupant.

H. Peninsula Desk: **F-8**

1. Manufacturer: KI "Aristotle Executive" Desk
2. Model: Quantity: 3
3. Description: 30"D x 60"W x 29"H LPL Laminate Desk, Full Modesty Panel, and Keyboard Tray.

I. Credenza: **F-9**

1. Manufacturer: KI "Aristotle Executive" Credenza w/ Freestanding Storage Pedestals
2. Model: KDA7224.E (Qty:1) / KF2BF.E (Qty:1) / KF2F.E (Qty:2)
3. Description: 24"D x 72"W x 29H, B/B/F, F/F, F/F, LPL Laminate, and Full Modesty Panel

J. Teachers Desk **F-10**

1. Manufacturers: KI "Aristotle Executive" Desk
2. Quantity: 1
3. Description: 24"D x 48"W x 29"H, LPL Laminate, and Full Modesty Panel

K. Bookcase **F-11**

1. Manufacturers: KI "Aristotle Executive" Bookcase
2. Model: KBC3672.E
3. Quantity: 1
4. Description: 12"D x 36"W x 72"H, HPL Bookcase, 5 Adj. Shelves, LPL Laminate

L. Moveable Stair: **F-12**

1. Manufacturers
 - a. EGA Model L070
 - b. C&H Products
 - c. Gillis Industries
2. Quantity: 1
3. Description: Meets or exceeds OSHA standards, up to 300 lb. capacity, platform height 140", lockable wheels, and with handrails.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set and level all non-mobile equipment to the correct height and anchor where indicated and/or required for secure installation. Use concealed anchors wherever possible. Anchors are to be non-corrosive and of adequate size for the Work.
- B. Assemble and install units complying with manufacturer's printed instructions in locations as shown on the Furniture Plan.

3.02 ADJUSTING

- A. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.
- B. Adjust furnishings for proper operation. Clean and polish exposed surfaces, using material and methods recommended by the manufacturer.
- C. Protect furnishings against damage during the remainder of construction period, complying with manufacturer's directions.

END OF SECTION 12 50 00

SECTION 12 65 00 – FIXED SEATING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes fixed seating with the following:

1. Floor mounted, molded-plastic stadium chairs (fixed audience seating).

1.03 SUBMITTALS

A. SD-03 Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fixed audience seating.

B. SD-02 Shop Drawings: Plans, elevations, and sections through rows showing seating layout; chair widths; accessories, including locations of left and right arms; and attachments to other Work.

C. SD-04 Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of finishes, colors, textures, and patterns available for each exposed material.

D. SD-04 Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Full size with finishes and accessories specified.
 - a. Approved Sample may become part of completed Work.

E. SD-08 Maintenance Data: For fixed audience seating to include in maintenance manuals specified in Division 1. Include the following:

1. Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Contractor with not less than five (5) years of successful experience in installation of furnishing similar to those required for this project.

B. Source Limitations: Obtain each type of seating required, including accessories and mounting components, through one source from a single manufacturer.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install seating until space is enclosed and weatherproof; wet work in space is complete and dry; finishes, including painting, are complete; and work above ceilings is complete. Do not install seating until ambient temperature and humidity conditions are continuously maintained at the levels anticipated for final occupancy.

B. Field Measurements: Verify seating layout by field measurements before seating fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Review delivery and storage conditions before and during installation. Review temporary protection requirements for furnishings during and after installation.

PART 2 - PRODUCTS

2.01 MATERIALS AND FINISHES

A. Steel: ASTM A 36/A 36M plates, shapes, and bars; ASTM A 570/A 570M hot-rolled sheet and strip; or ASTM A 620/A 620M cold-rolled sheet, finished with manufacturer's standard baked-on coating.

1. Color: As selected by Architect.

B. Molded Plastic: High-density polyethylene, blow or injection molded.

1. Color: As selected by Architect.

2.02 FIXED AUDIENCE SEATING

A. Basis-of-Design Product: The design is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified:

1. Product: The Medallion; Manufactured by Hussey Seating Co, North Berwick, Maine.

B. Other Available Manufacturers:

1. American Desk, ADMC, Inc.
2. American Seating Co.
3. GDS Seating, Inc.

4. Irwin Seating Co.
5. KI, Inc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements, and other conditions affecting fixed audience seating. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install seating in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions.

B. Install seating so moving components operate smoothly and quietly.

3.03 ADJUSTING

A. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

END OF SECTION 12 65 00

SECTION 12 93 00 – SITE FURNISHINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section specifies general requirements for site furniture including the following:

1. Precast concrete waste containers
2. Precast concrete snuffers

1.03 SUBMITTALS

A. SD-03 Product Data: Submit specifications, assembly, and installation instructions and general recommendations from manufacturers for each type of site furnishing required.

B. SD-08 Samples for Initial Selection: Manufacturer's color charts or sections showing the full range of finishes, colors, textures, and patterns available for each exposed material.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer (material producer) with not less than five (5) years of production of site furnishings similar to the items included under this Section.

B. Source Limitations: Obtain each type of site furnishing required, including accessories and mounting components, through one source from a single manufacturer.

1.05 PRODUCT STORAGE, DELIVERY AND HANDLING

A. All shipping, storage and delivery costs for equipment furnished by the site furnishings supplier.

B. Do not deliver site furnishings until authorized by the General Building Contractor. Verify storage areas with the prior to delivery. Verify delivery route and building access prior to fabrication or installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. For basis of design, the product model numbers are based on the site furnishing manufactured by Wausau Tile, Wausau, WI; Site Furnishing Division. Equivalent products from the manufacturers listed above will be accepted contingent on compliance with specifications that meet or exceed the products specified in this Section.

1. Custom Design Precast, Weston, WI
2. Petersen Manufacturing Co., Inc., Denison, IA

2.02 SITE FURNISHINGS SCHEDULE

A. Waste Container (Indicated as **'SF-1'** on the Furniture Plan, sheet A903.)

1. Manufacturer: Wausau Tile Model 'TF1029'
2. Quantity: 4
3. Description: 24" x 26" x 47" high, reinforced precast concrete with Granitex surface texture, 45-ga. capacity with liner. Include plastic lid, liner, security cable and cast logo.

B. Cigarette Receptacle Snuffer (Indicated as **'SF-2'** on the Furniture Plan, sheet A903.)

1. Manufacturer: Wausau Tile Model 'TF2052'
2. Quantity: 1
3. Description: 14" square x 34" high, reinforced precast concrete pyramid shaped with Granitex surface texture, galvanized pan and stainless steel access door. Include inkjet logo.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set and level site furnishing equipment where indicated on the drawings.

3.02 ADJUSTING

A. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

- B. Project site furnishings against damage during the remainder of construction period, complying with manufacturer's directions.

END OF SECTION 12 93 00

END OF DIVISION 12 – FURNISHINGS

DIVISION 31 – EARTHWORKS

SECTION 31 23 00 – EXCAVATION AND FILL

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section covers foundation requirements for the subject building only. This section covers all soil inside a volume bounded by the outside perimeter footings down to bottom of footing level, at which the volume expands outwards at a 1 foot downward for each 1 foot outward slope down to satisfactory native soils. Payment for the above defined earthwork is covered by this section alone. Payment and requirements for the remainder of the site earthwork is not covered by this section, but by other section(s) within the project specification.
- C. The Work under this Section includes:
 - 1. Preparing subgrades for slabs-on-grade.
 - 2. Excavating (including rock removal) and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Dewatering.
 - 5. Subsurface drainage backfill for walls and trenches
 - 6. Excavating and backfilling trenches within building lines.
 - 7. Geotextile separation type
 - 8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- D. Work included in other items:
 - 1. Site clearing and grubbing.
 - 2. Roadway excavation (including rock excavation).
 - 3. Bulk excavation to elevation(s) indicated on the drawings.
 - 4. Topsoil placement and finished grading.
 - 5. Excavation associated with static scale pit.
 - 6. Erosion control

1.02 RELATED SECTIONS

- A. Section 03 30 00 – Cast-in-Place Concrete for fine-graded granular material under vapor retarder.

- B. Division 22 and 26 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.
- C. Section 33 46 16 – Subdrainage Systems
- D. If rock is encountered, refer to the Standard Specifications for procedures.

1.03 REFERENCES

- A. Geotechnical Soils Report (December 10, 2012) prepared by CGC, Inc., Madison WI.

1.04 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- E. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by engineer. Additional excavation and replacement material will be paid for as Common Excavation per approval by engineer.
 - 2. Bulk Excavation: Excavations more than 10 feet (3 m) in width and pits more than 30 feet (9 m) in either length or width.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by engineer. Unauthorized excavation, as well as remedial work directed by engineer, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades.

- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- J. Proof-rolling: loading the native soil using a fully loaded, triaxle dump truck or other heavy construction equipment to detect soft or unstable soils, which will rut, yield or pump under load.

1.05 SUBMITTALS

- A. SD-04 Samples: Samples, of an adequate size and sealed in airtight containers, of each proposed soil material from on-site or borrow sources shall be submitted to the engineer for testing prior to performance of the work of this section.
- B. SD-09 Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

1.06 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 3740 and ASTM E 548, and acceptable to the engineer.

1.07 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by engineer and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify engineer not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without engineer's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active. Coordinate this work with building demolition contractor.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils:
1. ASTM D 2487 soil classification groups GW, GP, GM, SW, SP and SM, or a combination of these group symbols: free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
 2. ASTM D2487 soil classification groups GC, SC, CL or ML may be allowed to remain in place IF:
 - a. The soils are determined to be native to the position encountered and remain in their natural, undisturbed state
 - AND
 - b. The soils, as encountered, are determined to be capable of supporting the design loads imposed by the proposed structures.
 3. Under no circumstances shall the soils described in paragraph 2 be used for fill or as borrow.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups MH, CH, OL, OH, and PT, or a combination of these group symbols. ASTM D2487 soil classification groups GC, SC, ML, and CL, or a combination of these group symbols shall not be used as fill.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Compacted Granular Base: Drainage Course under vapor barrier below slabs-on grade, 6" minimum.

- E. Backfill and Fill: Satisfactory soil materials.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940: with at least 90% passing a 1-1/2 inch (38-mm) sieve and not more than 12 % passing a No. 200 (0.075-mm) sieve.
- G. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 % passing a 1-inch (38-mm) sieve and not more than 12 % passing a No. 200 (0.075-mm) sieve.
- H. Drainage Course: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (38-mm) sieve, 35 percent passing a 1-inch (25-mm) sieve, and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
- J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- K. Geotextile: Artificial fabric used as separation-type interface between proof-rolled native soil and subgrade fill.

2.02 GEOTEXTIL FABRIC

A Manufacturers

- 1. TenCate Geosynthetics North America; Mirafi ® 500X
- 2. Geo-Synthetics, Inc., Waukesha, WI; Soiltex™ ST 200W
- 3. US Fabrics, Inc; Cincinnati, OR; US 200

B Description: Woven geotextile complying with AASHTO-M-288-06 for Class 3 stabilization & separation applications. Geotextile fabric to be made of 100% polypropylene slit film yarns, resistant to ultraviolet and biological deterioration, rotting, naturally encountered basics and acids.

1.	Tensile Strength (ASTM D-4632):	200 lbs.
2.	Elongation @ Break (ASTM D-4632):	15%
3.	Mullen Burst (ASTM D-3786):	400 psi
4.	Puncture Strength (ASTM D-4833):	90 lb.
5.	CBR Puncture (ASTM D-6241):	700 lbs.

2.03 ACCESSORIES

- A. Warning Tape: Acid-and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam and dangerous materials.
 3. Orange: Telephone and other communications
 4. Blue: Water systems
 5. Green: Sewer systems

PART 3 – EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water run off or airborne dust to adjacent properties and walkways.
- D. Provide erosion control during the entire project as specified in Standard Specifications and elsewhere in the building specifications.

3.02 PROTECTION OF EXCAVATION

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. The installation of a dewatering system to keep subgrades dry and convey ground water away from excavations may be required during heavy rains. Maintain until dewatering is no longer required. Dewatering shall be considered incidental to the work of this section.
 - a. Areas to receive bentonite and membranes shall be dewatered to ensure surfaces are sufficiently dry for application of the waterproofing system.

3.03 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

- A. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavations will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents for Common Excavation.
 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections. Extend excavations down to acceptable native soils.
 1. Excavations for Footings, Foundations, Static Scale Tunnel, and Inspection Pits: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.06 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300mm) higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand excavate trench bottoms and support pipe and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.07 APPROVAL OF SUBGRADE

- A. Notify engineer when excavations have reached required subgrade.
- B. If engineer determines that unsatisfactory soil is present, continue excavation to a depth determined by the engineer and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid as Common Excavation per approval by engineer.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water or construction activities, as directed by the engineer.

3.08 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation, without altering top elevation. Lean concrete fill may be used when approved by the engineer.
 - 1. Fill unauthorized excavations under construction or utility pipe as directed by the engineer.

3.09 STORAGE OF SOIL MATERIAL

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 GEOTEXTILE PLACEMENT

- A. Per the Project Geotechnical Consultants' recommendations, install separation type geotextile, after approval of subgrade, and prior to placement of the granular fill.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - a. Backfill shall be placed and compacted immediately upon completion of installation of positive-side waterproofing and associated materials.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris
 - 6. Removing temporary shoring and bracing and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrel pipes and for joints, fittings and bodies of conduits.

- B. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm) to a height of 12 inches (300 mm) over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- D. Coordinate backfilling with utilities testing.
- E. Fill voids with approved backfill of satisfactory soil material to final subgrade.
- F. Place and compact final backfill of satisfactory soil material to final subgrade.
- G. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 FILL

- A Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under steps and ramps, use engineered fill
 - 2. Under building slabs, use engineered fill.
 - 3. Under footings and foundations, use engineered fill to a minimum depth of 18 inches below all footings.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2% of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2% and is too wet to compact to specified dry unit weight.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Grading inside Building Lines: Finish subgrade to a tolerance of ½ inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 DRAINAGE COURSE

- A. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:
 - 1. Compact drainage course to required cross sections and thickness to not less than 95% of maximum dry unit weight according to ASTM D 1557.
 - 2. When compacted thickness of drainage course is 6 inches (150 mm) or less, place materials in a single layer.
 - 3. When compacted thickness of drainage course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick when compacted.

3.18 DRAINTILE

- A. Install drainage pipe where indicated on the drawings. Refer to the structural and plumbing plans for details.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency that may be either part of, affiliated with, or independent of the owner, to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and

approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the engineer.

- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 sq. ft. (186 sq. m) or less of building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet (30 m) or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet (46 m) or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained, at no cost to owner.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by the engineer; reshape and recompact.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

3.22 NOTIFICATION OF EXISTING CONDITIONS

- A. The General Building Contractor will, upon becoming aware of subsurface or latent physical conditions differing from those disclosed by the original soil investigation work, promptly notify the engineer verbally to permit verification of

the conditions, and in writing, as to the nature of the differing conditions. No claim by the General Building Contractor for any conditions differing from those anticipated in the plans and specifications and disclosed by the soil studies will be allowed unless the General Building Contractor has notified the engineer, verbally and in writing, as required above, of such differing conditions.

END OF SECTION 31 23 00

END OF DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS
SECTION 32 31 19 – DECORATIVE METAL GATES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Factory finished hinge gates

B. Related Sections include the following:

1. Section 03 30 00 – Cast-in-place Concrete
2. Section 04 20 00 – Unit Masonry

1.03 SUBMITTALS

A. SD-02 Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.

B. SD-04 Samples for Verification: Submit sample of rail – picket joint with specified finish.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Quality procedures and personnel according to the following:

1. AWS D1.1, “Structural Welding Code – Steel.”
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Provide welding complying with American Welding Society Structural Welding Code for Steel, AWS D1.1.

D. Comply with applicable portions of Pipe Railing Manual, current edition, National Association of Architectural Metal Manufacturers (NAAMM).

1.05 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.06 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver fabrications, materials including accessories, anchor bolts, setting and bearing plates to the site at such intervals to ensure uninterrupted progress of the work.

B. Store fabrications and materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms or other supports. Protect steel members and packaged materials from erosion and deterioration. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replace damaged materials or structures when so ascertained.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Ameristar® Fence Products, Tulsa, OK; Montage IL

B. Approved equal

2.02 MATERIALS

A. Steel material for gate panels and posts shall conform to the requirements of ASTM A653M with a minimum yield strength of 45,000 psi and a minimum zinc (hot-dip galvanized) coating weight of 0.90 oz./ft², Coating Designation G-90.

1. Dumpster enclosure: 4" square
2. Stair Guardrail Gate: 3" square

B. Material for pickets shall be 1" square x 14-Ga. Tubing. The rails shall be steel channel, 1.75" x 1.75" x .105". Picket holes in the rail shall be spaced 4.715" o.c. Fence posts and gate posts shall meet the minimum requirements recommended by the manufacturer for project conditions.

2.03 ACCESSORIES

A. Gate Hardware

1. Hinges: Provide manufacturer's standard corrosion resistant adjustable heavy industrial 180 deg. hinges (1 pair per gate leaf).
2. Latch: Strong arm gate latch with padlock hasp.
 - a. Dumpster Enclosure: double gate latch; Ameristar Model DSB300.
 - b. Stair Guardrail Gate: Single gate latch; Ameristar Model DSB300.

B. Expansion Type Anchors

1. Hilti Kwik Bolt 11, steel expansion anchors for embedment in solid or precast concrete.
2. Hilti Hex Head (HX) Sleeve Anchors for anchoring into concrete masonry.

2.04 FABRICATION

A. Pickets, rails, and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection with fusion welding process to complete a rigid panel assembly. Joints shall be seamless and spatter-free.

C. The manufactured panels and posts shall be subjected to an inline electro-deposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic

topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils. The coating performance shall meet or exceed the criteria of ASTM F2408.

D. The manufactured gate and guardrail system shall be capable of meeting the vertical load, horizontal load and infill performance requirements for industrial weight fences under ASTM F2108.

E. Swing gates shall be fabricated using 1.75"x14-ga. Forerunner double channel rail, 2" square x 11-ga. Gate ends, and 1" sq. x 14-ga. Pickets. Gates that exceed 6 feet in width will have a 1.75" x 14-ga. Intermediate upright. All rail and upright intersections shall be joined by welding. Gusset plates will be welded at each upright to rail intersection. Cable kits will be provided for additional trussing for all gate leaves over 6 feet.

PART 3 – EXECUTION

3.01 INSTALLATION – GATES

A. Gate posts shall be located as indicated on manufacturer's shop drawings. Gate posts shall be set in drilled concrete piers extending to a minimum of 5 feet below the finished grade.

B. When cutting/drilling rails or posts, remove all metal shavings from cut area and apply manufacturer's recommended zinc-rich primer to thoroughly cover cut edge and/or drilled holes. Apply 2 coats of custom finish paint matching gate color.

C. Gate posts shall be set plumb.

D. Install hardware as recommended by manufacturer.

END OF SECTION 32 31 19

END OF DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

SECTION 33 21 13 – WELL PUMP AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Drilling, casing, grouting, disinfection, and certification of a new domestic water well and related appurtenances suitable for commercial use.
- B. Furnishing and installation of pumping equipment and controls, including submersible well pump suitable for variable speed duty, variable speed controller with pressure transducer, pressure gauge, and related appurtenances.
- C. Furnishing and installing one diaphragm-style pressure tank.
- D. Furnishing and installation of piping from well to building, including connection to pressure tank and installation of Building Control Valve.

1.02 RELATED SECTIONS

- A. Section 31 23 33 - Utility Excavation, Backfill, and Compaction.

1.03 REFERENCES

- A. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- C. ASTM D2104 - Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.
- D. ASTM D2239 - Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
- E. ASTM D2447 - Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
- F. ASTM D3035 - Specification for Polyethylene (PE) Plastic Pipe (DR_PR) Based on Controlled Outside Diameter.
- G. AWWA C901 - Standard for Polyethylene (PE) Pressure Pipe and Tubing 1/2 In. (13 mm) through 3 In. (76 mm) for Water Service.

H. NR 812 - Wisconsin Administrative Code, Well Construction and Pump Installation.

1.04 QUALITY CONTROL

- A. Work shall be done according to NR 812.
- B. Contractor shall obtain any required state approvals.

1.05 SUBMITTALS

- A. Submit drilling report to engineer detailing soil conditions and water table levels.
- B. Submit test pumping report to engineer.
- C. Submit water sampling laboratory results to engineer.
- D. Submit manufacturer's literature on well pump, pitless adapter, and control system.

1.06 WELL CONSTRUCTION

- A. The well for this project shall be constructed new for this application.
- B. Design flow rate is 55 GPM
- C. Design water pressure is 50 PSI at the Building Control Valve
- D. Well bore shall be a minimum of 6 inches and a maximum of 8 inches.
- E. Well shall be drilled to depth necessary to a secondary water table in this area. For Bidding purposes, the Contractor shall assume a depth of 220 feet. The actual depth will be based on field conditions and the cost of this will be adjusted per unit prices submitted at the time of Bidding.
- F. In the Bidding Documents, submit a Unit Price for 1 foot of drill depth and water pipe.
- G. Final well depth shall exceed the static water level by 20 feet.
- H. The well shall be cased to 20 feet below static water level. Well casing shall be PVC with slotted PVC strainers in the water table.
- I. Well casing shall be grouted with a cementitious grout meeting the requirements of WI DNR NR 812.
- J. Drop Pipe: 2".

PART 2 - PRODUCTS

2.01 PUMP AND CONTROLS

A. Pump and Control Manufacturer: Goulds Pumps, Grundfos, Red Lion, Flotec or equal.

B. Pump

1. Submersible turbine pump.
2. Power Supply: 240 volt, 3-wire, 60 Hz, single phase.
3. Pump Characteristics:
 - a. Capacity: 55 GPM
 - b. HP: Max. 7-1/2 HP
 - c. Speed: 3,450 RPM
 - d. Outlet Size: 2".
 - e. Pump Setting: (To be determined)
 - f. Head:
 - g. Lift above well 126.5 Ft
 - h. Lift out of well 200.0 Feet
 - i. Total Head 326.5 Feet
 - j. Final head conditions will be based on test pumping.

C. Controls: provide a constant pressure control system, Goulds Pumps Balanced Flow™ or equal. The controller shall be a variable speed, constant pressure controller designed for submersible well pumps. Controller shall maintain a pressure of 50 PSI.

1. Accessories:
 - a. Diaphragm pressure tank.
 - b. Pressure transducer.
 - c. Relief valve.
 - d. Pressure gauge.
 - e. Sample faucet.

2.02 WATER SERVICE PIPE

A. All water service pipe shall have a minimum pressure rating of 150 psi.

B. Polyethylene Pipe: ASTM D2104, ASTM D2239, ASTM D2447, ASTM D3035, or AWWA C901.

2.03 DROP PIPE

A. All drop pipe shall have a minimum pressure rating of 150 psi.

B. PVC: ASTM D1785.

C. Galvanized Steel: ASTM A53

2.04 BEDDING AND COVER MATERIAL

A. Provide bedding and cover material meeting the requirements of ASTM D2321, Class IA, IB, II or III described as follows:

B. Class IA - Clean angular crushed stone, crushed rock, or crushed gravel conforming to the following gradation:

Sieve Size	% Passing By Weight
1"	100
3/4"	90 - 100
3/8"	20 - 55
No. 4	0 - 10
No. 8	0 - 5

C. Class IB - Clean angular crushed stone, crushed rock, or crushed gravel conforming to the following gradation:

Sieve Size	% Passing By Weight
1/2"	100
3/8"	85 - 100
No. 4	10 - 30
No. 200	0 - 5

D. Class II - Clean coarse-grained soils free from organic matter, trash, debris, stones larger than 1-inch, and frozen material and classified in ASTM D2487 as follows:

1. GW - Well-graded gravels, gravel-sand mixtures, little or no fines.
2. GP - Poorly-graded gravels, gravel-sand mixtures, little or no fines.
3. SW - Well-graded sands, gravelly sands, little or no fines.
4. SP - Poorly-graded sands, gravelly sands, little or no fines.
5. Excavated trench material may be used if it meets the above material requirements.

E. Class III - Coarse-grained soils with fines free from organic matter, trash, debris, stones larger than 1-inch, and frozen material and classified in ASTM D2487 as follows:

1. GM - Silty gravels, gravel-sand-silt mixtures.
2. GC - Clayey gravels, gravel-sand-clay mixtures.
3. SM - Silty sands, sand-silt mixture.

4. SC - Clayey sands, sand-clay mixtures.
5. Excavated trench material may be used if it meets the above material requirements.

PART 3 - EXECUTION

3.01 PUMPING TEST

- A. Perform a yield and drawdown test at the completion of the well casing. Provide pumping equipment capable of pumping within a range of 5 GPM to 30 GPM
- B. Provide all of the necessary equipment and piping to accurately measure the pumping rate and the water level.
- C. Unless the time is extended by the engineer, the pump test shall continue for four hours. Pumping rates and corresponding water levels shall be recorded at intervals of not more than 30 minutes
- D. Keep a log of the test pumping and submit the log to the engineer at the end of the test. The log shall include the following information:
 1. Pump setting
 2. Static water level
 3. Pumping rate and water level at specified intervals
 4. Recovery water levels
 5. Other pertinent data

3.02 DISINFECTION

- A. Following pumping test, thoroughly disinfect the well according to NR 812.22 (4).

3.03 WATER QUALITY ANALYSIS

- A. After completion of the test pumping and after disinfection, collect water samples for testing by the State Laboratory of Hygiene or other laboratory approved by the DNR, and transport the samples to the lab. Laboratory analysis shall include: coliform, pH, hardness, iron, manganese and nitrates.

3.04 PUMP INSTALLATION

- A. Provide pump with characteristics based on the test pumping.
- B. Final pump setting will be based on test pumping.
- C. Provide new pitless adapter and well cap.

3.05 WATER SERVICE PIPE INSTALLATION

- A. Install pipe with 6.5 ft. of cover.
- B. Bedding and Cover: Place 4" of bedding material beneath pipe. Place bedding material around the pipe and to a level six inches above the pipe. Work the material in and around the pipe.
- C. Provide a trace wire for the pipe.
- D. Backfill according to Section 31 23 33.

END OF SECTION 33 21 13

SECTION 33 36 33 – PRIVATE WASTE DISPOSAL SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Installation and certification of a private waste disposal system as shown on the Drawings and herein specified.
- B. Installation and certification of a private waste holding tank as shown on the Drawings and here specified.

1.02 RELATED SECTIONS

- A. Section 22 05 00 - Common Work Results for Plumbing.
- B. Section 22 05 05 - Plumbing Materials and Equipment.

1.03 REFERENCES

- A. Wisconsin Administrative Code Comm 82 - Design, Construction, Installation, Supervision, Maintenance, and Inspection of Plumbing.
- B. Wisconsin Administrative Code Comm 83 - Private Onsite Wastewater Treatment Systems.
- C. Wisconsin Administrative Code Comm 84 - Plumbing Products.
- D. Wisconsin Administrative Code Comm 85 - Soil and Site Evaluations.

1.04 WORK INCLUDED

- A. Connection to the sanitary sewer at the building, extension to the private on site waste treatment system as shown on the Drawings.
- B. Connection to the oil-contaminated sanitary sewer at the building and extension to the holding tank as shown on the Drawings.

1.05 SUBMITTALS

- A. Submit detailed drawings on all tanks, vessels, structures and related accessories and appurtenances.
- B. Submit detailed performance and dimensional information on all pumps, including performance noted for this particular installation.
- C. Submit manufacturer literature and wiring directions for all alarms and accessories.
- D. Submit manufacture literature on all septic pipe and structures.

PART 2 - PRODUCTS

2.01 PRODUCTS

- A. All products shall meet the requirements of Comm 84, and Section 22 05 05.
- B. Septic Tank:
 - 1. The septic tank shall be a combination, dual compartment, precast concrete structure with (3) manholes and extensions above grade.
 - 2. The septic section shall be nominal 1,500 gallon capacity with 4 inch PVC inlet connection, inlet baffle, outlet filter with handle for easy removal, and (2) manholes positioned for visual observation of the inlet baffle and access to the removable outlet filter.
 - 3. The pump chamber shall be nominal 1,500 gallon capacity with 4 inch PVC outlet connection and manhole positioned over the outlet location.
 - 4. Provide pre-cast concrete manhole extension rings as necessary so the manhole covers are located a minimum of 18 inches above finished grade.
 - 5. Manhole covers shall be pre-cast concrete and shall include a metal plate engraved with standard Warning signs per current WI Code requirements. Manhole covers shall include a chain and cast-in place loops to allow locking of the covers in the closed position.

6. Vessel or manhole cover shall be equipped with a 4 inch vent connection.
7. Concrete shall be nominal 5,000 PSI.
8. Vessel dimensions shall be as noted on the Drawings.
9. Vessel shall be pre-approved by the Wisconsin Department of Safety and Professional Services. Vessels without approval already on file at the time of Bidding will not be acceptable.

C. Holding Tank:

1. The holding tank shall be a single compartment, precast concrete structure with (2) manholes and extensions above grade.
2. The holding tank shall be nominal 5,000 gallon capacity with 4 inch PVC inlet connection, inlet baffle, (1) manhole positioned for visual observation of the inlet baffle.
3. Provide pre-cast concrete manhole extension rings as necessary so the manhole covers are located a minimum of 18 inches above finished grade.
4. Manhole covers shall be pre-cast concrete and shall include a metal plate engraved with standard Warning signs per current WI Code requirements. Manhole covers shall include a chain and cast-in place loops to allow locking of the covers in the closed position.
5. Vessel or manhole cover shall be equipped with a 4 inch vent connection.
6. Concrete shall be nominal 5,000 PSI.
7. Vessel dimensions shall be as noted on the Drawings.
8. Vessel shall be pre-approved by the Wisconsin Department of Safety and Professional Services. Vessels without approval already on file at the time of Bidding will not be acceptable.

D. Septic Field Pumps:

1. Two pumps shall be required for primary and standby duty.
2. Pumps shall be submersible design, cast iron construction, with integral support feet to maintain a 1" gap between the floor of the vessel and the suction opening to the pump.

3. Pumps shall be “Sewage” duty capable of passing an object $\frac{3}{4}$ inch in diameter without damage to the pump.

4. Equip pumps with a lift chain and handle. A rail system is not required. Piping shall be arranged to disconnect each pump manually at the discharge manhole while allowing the standby pump to operate. This means shall be a union or companion flange. Lift chains shall be stainless steel construction and suitable for lifting of 300 pounds weight. Provide and install a sturdy hook at the top of the inspection manhole to secure the lift chains when not in use.

5. Discharge piping shall include a check valve and a manual isolation valve for each pump. Check valves shall be installed within 18 inches of the pump connection. Isolation valves shall be installed at the top of the manhole.

E. Pump Controls:

1. A duplex pump control with local and remote alarm capabilities shall be provided. The pump control shall be located in immediate proximity to the pump chamber of the septic tank. The control panel shall include the following:

- a. A main disconnect switch to disconnect power to the entire panel
- b. Manual “Hand-Auto-Off” selector switches for each pump concealed behind a lockable cover.
- c. Contactors with overload protection for each pump – selected for the actual pump. Pumps with internal overload protection do not require additional overload protection in the control panel.
- d. Indicator lights to indicate: “Power On”, “Pump On”, “Pump Failure”. These indicators shall be concealed behind a lockable cover.
- e. A red-colored exterior-duty light shall be located for remote indication of a high water level condition.
- f. Include a 4-float assembly for:
 - 1) Pumps off
 - 2) Pump #1 on
 - 3) Pump #2 on
 - 4) High level alarm.
- g. The entire control panel shall be NEMA 4X rated.
- h. Include a separate contact for a remote alarm indication. This contact shall be a dry contact for use with a separately-powered signal.

F. Septic Field (Leach Field) Chambers:

1. The septic field shall be constructed using pre-formed, semi-spherical polyethylene chambers designed for row mounting with interlocked end sections.

2. Each structure shall have nominal dimensions of 34 inches wide by 12 inches high by 48 inches long.

3. The system shall allow for piping connections at either end or mid-point using matching components.
4. Leachfield chambers shall be designed such that stone or geotextile coverings are not required.
5. Leachfield structures shall support upto 16,000 pounds of uniform load when installed with 12 inches of compacted cover or better.

G. Pipe:

1. All piping installed exterior to the building, but installed under a traffic surface, shall be Schedule 40 PVC, DWV-rated, with solvent-welded patching PVC fittings.
2. All piping installed exterior to the building, but in areas not subject to vehicle traffic shall be SDR35 PVC with Schedule 40 PVC solvent weld fittings.

PART 3 – EXECUTION

301 INSTALLATION

- A. The Contractor shall carefully examine the Design Documents with the site development and report any discrepancies or concerns to the engineer. The site at the project is being substantially elevated. If the area of these septic structures are sufficiently disturbed that weight bearing capacity is a concern, report this condition to the engineer and proceed no further without direction.
- B. This Contractor is responsible to obtain all local and State permits for the installation of the POWTS components. The Owner will supply a contract for the hauling and disposal of materials within the holding tank. The Contractor shall not assume any costs or responsibility for this work.
- C. Coordinate the installation of the septic field with the local authorities so inspections may be made in a timely fashion.
- D. Vessels:
1. All pre-cast concrete vessels shall be installed on a solid, level base free of rocks, debris and similar.
 2. Provide and install a granular base for all vessels consisting of river rock (natural product) install a minimum of 3 inches in depth. Aggregate size may not exceed 1-1/2" inches.

3. This site is not in a floodway and no high water conditions are anticipated. No vessel ballasting shall be required. Should groundwater be encountered during excavation, stop work and report the condition to the engineer.

4. Place the vessels and level.

5. Vessels may be backfilled with excavated materials if free of rock, debris, or similar items. Backfill in 8 inch lifts and compact with jumping jack or similar device. Do not compact with self-propelled machinery, excavators, or similar.

6. Extend manholes to 18 inches above finished grade, including the depth of the pre-cast covers. Ensure warning labels are visible and intact. Provide temporary locks on all manholes during the construction process.

E. Septic Field / Leach Field:

1. Construct the septic field as shown on the drawings and per applicable Wisconsin Code.

2. Level the septic area using care not to disturb the site more than necessary.

3. Once the septic area is prepared and visible, request an inspection from the local authority to document soil conditions are in compliance with the soil test report. Report any deviations to the engineer for review.

4. Place the septic field chambers as shown on the drawings and ensure they bear solidly on the soil. Infill void areas to provide a uniform bearing surface.

5. Connect all piping per the Drawings. Elevated piping shall be temporarily supported until backfill is complete.

6. At this point, the Contractor shall photograph the installation and key the photographs to the septic tank. Make notations on the drawings to reflect the as-built dimensions and configuration. Photographs shall be delivered to the engineer in a digital format. The engineer shall visit the site to observe the placement and piping of the field prior to any covering or backfill is installed. This Contractor shall arrange for required inspections by the local authority.

7. Once inspected and approved, backfill the septic field carefully ensuring that piping is adequate supported and septic chambers are not dislodged. Backfill with materials as noted on the Drawings. Compact with manually operated jumping jacks or vibratory plate compactors in lifts not to exceed 6 inches. Restore the site to rough grade elevations and smooth the surface to a manner suitable for final grading and seeding by others.

F. Control Panel and Wiring:

1. This Contractor shall provide and install a means to support the control panel at the septic tank. Galvanized 1-5/8" unistrut channel installed in concrete-filled piers shall be used. Treated wood posts will not be acceptable. Construct a ladder assembly to support the control panel as well as all conduit.
2. Secure the control panel to the ladder frame.
3. The Electrical Contractor will provide and install all conduit and line voltage wiring. This Contractor shall install the floats and extend the float cables through the conduit into the control panel. The Electrical contractor shall make all final connections.
4. This Contractor shall set the float heights as noted on the Drawings.
5. At the completion of all wiring, this Contractor shall fill the pump chamber with clean water to test that the floats work correctly and the pumps operate correctly. This test shall be scheduled with the engineer to observe the test procedure. Water for this testing may be obtained from the building.

END OF SECTION 33 36 33

SECTION 33 46 16 – SUB-DRAINAGE SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Applicable provisions of Division 1 shall govern the work under this Section.
- B. Work Includes
 - 1. Building perimeter foundation subdrainage system.
 - 2. Filter aggregate
 - 3. Filter fabric.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 03 30 00 – Concrete: Installation of pipe sleeves for routing thru foundations.
- B. Section 31 23 00 – Excavation and Fill: Utility Trench Backfill

1.03 RELATED SECTIONS

- A. Section 31 23 00 – Excavation and Fill: Excavating subsoil for sub drainage system piping.

1.04 REFERENCES

- A. ASTM D2729 – Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.

1.05 SUBMITTALS

- A. SD-03 Submit product data.

1.06 PROJECT RECORD DOCUMENTS

- A. Accurately record location of pipe runs, connections, cleanouts and invert elevations.

PART 2 – PRODUCTS

2.01 PIPE MATERIALS

- A. Polyvinyl Chloride Pipe: ASTM D2729;

1. Provide perforated, 4 inch inside diameter rigid piping at perimeter footing drain tile locations where indicated on the plans. Corrugated plastic tubing will not be accepted.

2.02 FILTER AGGREGATE

- A. Coarse Filter Aggregate: Clean, well graded, natural gravel, crushed stone, free from shale, clay, organic, materials or debris.
- B. Fine Filter Aggregate: Clean, natural sand; free from silt, clay, organic matter or soluble materials; graded within the following limits:

2.03 ACCESSORIES

- A. Pipe Sleeve: Continuous perforated plastic.
- B. Filter Fabric: Water previous type, black polyolefin.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that trench cut excavation base is ready to receive work, and excavations, dimensions, and elevations are prepared to maintain a consistent and constant slope.
- B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fill material.

3.03 INSTALLATION

- A. Install and join pipe and pipe fittings according to manufacturers' instruction.
- B. Lay pipe to slope gradients noted on drawings with minimum pitch of 1/16" per foot.
- C. Install coarse filter aggregate at sides and over and top of pipe. Provide top cover compacted thickness of 12 inches.
- D. Place filter fabric over leveled top surfaces of filter aggregate cover prior to subsequent backfilling operations.
- E. Connect to precast concrete sump basin in Scale Tunnel 001.

3.04 PROTECTION

A. Protect pipe and filter aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION 33 46 16

END OF DIVISION 33 - UTILITIES

42. SWEF Building, Plumbing, Item SPV.0105.102.

A Description

This item consists of the plumbing work for the SWEF building. The work shall be according to the applicable plans and the following specifications.

B (Vacant)

C (Vacant)

D Measurement

The department will measure SWEF Building, Plumbing, completed in accordance 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.0105.102	SWEF Building, Plumbing	LS

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

DIVISION 21 – FIRE SUPPRESSION

SECTION 21 05 00 – COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 – GENERAL

1.01 SCOPE

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. This section includes information common to two or more technical fire protection specification sections or items that are of a general nature, not conveniently fitting into other technical sections.
- C. The scope of fire suppression includes a dry-pipe sprinkler system for the truck inspections bay (Inspections 124) serviced from a fire department connection located on the south wall of the Inspections area of the building.

1.02 RELATED SECTIONS

- A. Section 21 05 29 – Hangers And Supports For Fire Suppression Piping And Equipment

B. Section 21 13 16 – Dry-Pipe Sprinkler System

1.03 STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1. AGA American Gas Association
2. ANSI American National Standards Institute
3. ASME American Society of Mechanical Engineers
4. ASPE American society of Plumbing Engineers
5. ASTM American Society for Testing and Materials
6. AWWA American Water Works Association
7. AWS American Welding Society
8. CGA Compressed Gas Association
9. CS Commercial Standards, Products Standards Sections, Office of Engineering Standards Service, NBS
10. EPA Environmental Protection Agency
11. FS Federal Specifications, Superintendent of Documents, U.S.Government Printing Office
12. IAPMO International Association of Plumbing & Mechanical Officials
13. IEEE Institute of Electrical and Electronics Engineers
14. ISA Instrument Society of America
15. State of Wisconsin DSPS Safety and Buildings
16. MCA Mechanical Contractors Association
17. MICA Midwest Insulation Contractors Association
18. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
19. NBS National Bureau of Standards
20. NEC National Electric Code
21. NEMA National Electrical Manufacturers Association
22. NFPA National Fire Protection Association
23. STI Steel Tank Institute
24. UL Underwriters Laboratories Inc.

1.04 QUALITY ASSURANCE

A. Substitution of Materials: Refer Section 01 25 00 – Substitution Procedures.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. 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 for obtaining the intended performance from the system into which these items are placed.

1.05 SLEEVES AND OPENINGS

A. Refer to Division 1, General Requirements, Sleeves and Openings.

1.06 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.08 PROVISIONS FOR FUTURE

A. Explain what systems or subsystems have been sized for future expansion and what the Contractor must do to maintain these provisions. This article is not needed if equipment is the only item that has been sized for future and the future capacity of that equipment is indicated on schedules.

1.09 CODES

A. Comply with requirements of Wisconsin Administrative Code, DSPS Safety and Buildings, NFPA Standards and local Fire Chief or Fire Marshal (AHJ, Authority Having Jurisdiction) regarding design, materials and installation.

1.10 DESIGN CRITERIA

A. Design fire protection systems according to codes, standards and regulations noted above.

B. The A/E is responsible for selecting the occupancy classification and density for all locations within the project based on NFPA occupancy definitions and examples. Potential future occupancy change as well as current planned occupancy should be used in determining classification. Higher than minimum areas from NFPA 13, Fig. 5-2.3 may be selected where greater than normal hazard potential is anticipated. Check other NFPA chapters as necessary.

1.11 CERTIFICATES AND INSPECTIONS

A. Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer according to Wis Admin. Code Section ILHR/COMM 50.12. Deliver originals of these certificates to the Division's construction representative. Include copies of the certificates in the Operating and Maintenance Instructions.

1.12 SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures

B. SD-02 Shop Drawings: Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

1. Submittals shall be sent to the local Fire Chief or Fire Marshal for review prior to the Architect/Engineer. Include copy of review/approval letter in submission to Architect/Engineer.

2. Submit plans indicating water supply location and size, piping layout and size, sprinkler locations and type, hanger locations and type, equipment locations and type, valve locations and type, occupancy classes, hydraulic reference points, design areas and discharge densities.

C. SD-03 Product Data: Not more than two weeks after award of contract but before any shop drawings are submitted, contractor to submit the following fire protection system data sheet. List piping material types, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves, specialties and equipment with manufacturer and model number. The approved fire protection system data sheet(s) will be made available to the Owners Project Representative for their use on this project.

FIRE PROTECTION SYSTEM DATA SHEET

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Hangers & Supports			
Sprinkler Heads			
Valves			
Specialty Valves			
Pipe Specialties			
Fire Protection Specialties			
Fire Protection Equipment			

D. SD-05 Design Data: Submit hydraulic calculations for water supply and sprinkler systems. Include summary sheet and detailed work sheets. Describe characteristics of water supply and location of effective point used in calculations. Include graph illustration of water supply, hose demand, sprinkler demand and in-rack sprinkler demand. Where a fire pump is used, graph primary rating point, secondary rating point and churn pressure of pump and combined water supply.

E. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:

1.	Operating and Maintenance Manuals	2 copies
2.	Architect/Engineer	1 copy
3.	City of Sparta Fire Department	1 copy

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

B. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. Copies of all approved submittals along with approval letters.
2. Manufacturer's wiring diagrams for electrically powered equipment.
3. Records of tests performed to certify compliance with system requirements.
4. Certificates of inspection by regulatory agencies.
5. Parts lists for equipment and specialties.
6. Manufacturers installation, operation and maintenance recommendations for equipment and specialties.
7. Valve schedules
8. Lubrication instructions, including list/frequency of lubrication
9. Warranties

1.14 TRAINING OF OWNER PERSONNEL

A. Prior to project close-out, instruct Owner's personnel in the proper operation, maintenance and testing of systems and equipment provided as part of this project. Include

not less than four hours of instruction, using the Operating and Maintenance manuals and record drawings during this instruction. Demonstrate testing, startup and shutdown procedures for all equipment. All training to be during normal working hours.

1.15 RECORD DOCUMENTS

A. Refer to Division 1, General Requirements, Record Documents.

B. In addition to the data indicated in the General Requirements, maintain fire protection layout record drawings and hydraulic calculations on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings and calculations with the Operating and Maintenance manuals.

PART 2 – PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Coordinate the location of all access panels and doors with the Architect.

2.02 KEY BOX

A. The Fire Protection Contractor shall be responsible for obtaining and completing forms required by the City of Sparta Fire Department for the key box assembly to be purchased by the contractor.

B. Manufacturer

1. Knox Company, Phoenix, AZ: 3200 Series Recessed Mount

2. Mounting: Recessed welded steel case with 7" x 7" flange. Housing to be installed in RMK shell box, 6" x 6" x 4" deep.

3. Lock: UL Listed, double-action rotating tumblers and hardened steel pins accessed by a biased cut key.

2.03 IDENTIFICATION

A. Stencils: Not less than 1/2" high letters for pipe sizes 1" through 2-1/2" and 1 inch high letters/numbers for pipe sizes 3" and above for marking pipe and equipment. Apply flow arrows to piping.

B. Adhesive Labels: Pressure-sensitive, adhesive backed, vinyl pipe markers with applicable labeling, 3/4" min. size for lettering and surrounding tape on both ends. With flow arrows on piping. Conforming to ANSI, ANSI and NFPA standards. Seton Opti-Code, MSI, Brady or approved equal. Clean piping before application.

C. Snap-Around Markers: One-piece, pre-formed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling, 3/4" min. size for lettering. Provide nylon ties on each end of pipe marker. Seton Setmark or approved equal.

D. Signs: Metal construction, baked porcelain enamel finish signs, sizes conforming to NFPA no. 13 and 7-1.2, with holes and s-hooks/chains for hanging or securing. With applicable labeling. MSI, Seton, W.H. Brady or equal.

E. Engraved Name Plates: White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by W. H. Brady.

F. Valve Tags: Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains with brass "S" hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, MSI or W. H. Brady.

2.04 SEALING AND FIRESTOPPING - FIRE AND/OR SMOKE RATED PENETRATIONS

A. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that sufficient space is available for the penetration to be effectively fire and smoke stopped.

B. Manufacturers: 3M, Hilti, STI/SpecSeal, Tremco, or approved equal.

C. All firestopping systems shall be provided by the same manufacturer.

D. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Dept. of Safety and Professional Services.

E. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

F. The contractor will be responsible for selecting the appropriate UL tested fire stop system for each application required on the project and will submit this to the A/E for review. Each firestop manufacturer has specific details for different applications they have tested. The specification has been written this way because the A/E cannot anticipate what manufacturer or system the contractor is basing their bid on. Therefore, do not show any firestopping details on the drawings.

G. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors. A/E must identify locations of smoke partitions, fire rated walls and their hourly rating on drawings.

H. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

2.05 NON-RATED PENETRATIONS

A. Pipe Penetrations:

1. 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. For non-rated drywall, plaster or wood partitions where sleeve is not required, use urethane caulk in annular space between pipe insulation and wall material.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

A. Refer to Division 1, General Requirements, Cutting and Patching.

3.02 COORDINATION WITH OTHER TRADES

A. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.03 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion.

B. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

C. Identify interior piping mains not less than once every 25 feet, not less than once in each room, adjacent to each access door or panel, and on both sides of the partition where exposed piping passes through walls or floors. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background, or approved pipe marking label systems, or provide snap-around type pipe markers as specified in Part 2 – Products.

D. Identify valves with signs per NFPA rulings.

E. Provide hydraulic design information sign of permanently marked weatherproof metal or engraved nameplate material. Secure to alarm valve with brass chain. Information to include location of the design areas, discharge densities, required flow and residual pressure at the base of riser, hose stream demand and sprinkler demand.

3.04 LUBRICATION

A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication according to the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.05 SLEEVES

A. Provide galvanized sheet metal sleeves for fire rated pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall. In existing poured concrete walls where penetration is core drilled, pipe sleeve is not required. Grout holes directly around steel pipe.

B. Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.

C. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run thru sleeve), cast in place.

D. In all piping floor penetrations, fire rated and non-fire rated, top of sleeve shall extend 1 inch above the adjacent finished floor. In existing floor penetrations, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to existing floor structure.

3.06 SEALING AND FIRESTOPPING

A. Fire And/Or Smoke Rated Penetrations:

1. Install approved product according to the manufacturer's instructions where a pipe penetrates a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support substantial weight.

B. Non-Rated Partitions:

1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

END OF SECTION 21 05 00

SECTION 21 05 29 – HANGERS & SUPPORTS FOR FIRE SUPPRESSION PIPING & EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. This includes specifications for supports of all fire protection equipment and materials as well as piping system anchors.

1.02 RELATED WORK

- A. Section 21 05 00 – Common Work Results For Fire-Suppression
- B. Section 21 13 16 – Dry-Pipe Sprinkler System

1.03 REFERENCE

- A. Applicable provisions of Division 1 shall govern work under this section.

1.04 REFERENCE STANDARDS

- A. MSS SP-58
- B. MSS SP-69
- C. NFPA 13: Installation of Sprinkler Systems (Latest prevailing addition).
- D. NFPA 14: Installation of Standpoint and Hose Systems (Latest prevailing addition).
- E. NFPA 20: Installation of centrifugal fire pumps (Latest prevailing additions).
- F. UL: Underwriter's Laboratories Listed.
- G. FM: Factory Mutual Approved

1.05 DESCRIPTION

- A. Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

- B. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.
- C. Fasteners depending on soft lead for holding power or requiring explosive powder actuation will not be accepted.
- D. 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.

1.06 SUBMITTALS

- A. Refer to Section 01 33 00 – Submittal Procedures
- B. SD-02 Shop Drawings
 - 1. Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service. Provide details on the working drawings submitted for approval with all pertinent information listed.

1.07 DESIGN CRITERIA

- A. Materials and application of pipe hangers and supports shall be according to MSS Standard Practice SP-58 and SP-69 unless noted otherwise. Materials and application of pipe hangers and supports shall be according to NFPA rulings and be UL/FM listed and approved.
- B. Piping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. B-Line, anvil, Pate, Piping, Technology, Roof Products & Systems or approved equal.

2.02 STRUCTURAL SUPPORTS

- B. Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspend or floor supported tanks and equipment. All of this steel may not be specifically indicated on the drawings.

2.03 PIPE HANGERS AND SUPPORTS

A. HANGERS FOR PIPE SIZES ½" THROUGH 4":

1. Carbon steel. Adjustable swivel ring with 3/8" min. UL/FM approved hanger rods. B-Line B3170NF, anvil 69 or 70.
2. Carbon steel, adjustable clevis, standard, with UL/FM approved size hanger rods. B-Line B3100, Anvil 260.

B. HANGERS FOR PIPE SIZES 4" THROUGH 8

1. Carbon steel adjustable swivel ring with ½" min. UL/FM approved hanger rods. B-Line B3170NF, Anvil 69 or 70.
2. Carbon steel, adjustable clevis, standard with UL/FM approved size hanger rods. B-Line B3100, anvil 260.

C. HANGERS FOR PIPE SIZES 10" AND UP

1. Carbon steel, adjustable clevis, standard with UL/FM approved size hanger rods. B-Line B3100, Anvil 260.

D. MULTIPLE OR TRAPEZE HANGERS

1. Manufactured steel channel system with manufacturers slotted interlocking pipe clamps with screw/nut securing and threaded hanger rods or steel channels with welded spacers and threaded hanger rods.

E. WALL SUPPORT

1. Carbon steel welded bracket with hanger. B-Line 3060 Series, anvil 190 Series. Steel channels with pipe clamps.

F. VERTICAL SUPPORT

1. Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

G. FLOOR SUPPORT

1. Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

H. COPPER PIPE SUPPORTS

1. All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp. Equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Grinnell PS 1400 series.

2.04 PIPE HANGER RODS

A. STEEL HANGER RODS

1. Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
2. Size rods for individual hangers and trapeze support as indicated in the following schedule.

<u>Pipe Size</u>	<u>Diam. of Rod</u>
Up to and Including 4"	3/8" or 9.5mm min.
5", 6" and 8"	1/2" or 12.7mm min.
10" and 12"	5/8" or 15.9mm min.

2.05 BEAM CLAMPS

A. MSS SP-69 types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw. B-Line B3036L/B3034, Anvil 86/92.

B. MSS SP-69 type 28 or type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter. B-Line B3054, Anvil 228.

2.06 CONCRETE INSERTS

A. POURED IN PLACE:

1. MSS SP-69 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by concrete in compression to maximize the load carrying capacity. B-Line B2505, Anvil 281.
2. MSS SP-69 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. B-Line B301N, Anvil 282.

B. DRILLED FASTENERS:

1. Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

2.07 CONTINUOUS CONCRETE INSERT CHANNELS

A. Steel inserts with an industry standard pre-galvanized finish, nominally 1-5/8 inch by 1-3/8 inch deep by length to suit the application, designed to be nailed to concrete forms and provide a linear slot for attaching other support devices. Installed channels to provide a load rating of 2000 pounds per foot in concrete.

B. Manufacturer's standard brackets, inserts, and accessories designed to be used with channel inserts may be used. Select insert length to accommodate all pipe sizes in the area.

2.08 ANCHORS

A. Use welding steel shapes, plates, and bars to secure piping to the structure.

B. Equipment stands

1. Use structural steel members welded to and supported by pipe supports. Clean, prime and coat with three coat rust inhibiting alkyd paint or one coat epoxy mastic. Where exposed to weather, treat with corrosive atmosphere coatings.

2.09 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication. ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanize threaded products, ASTM B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:

1. Exterior locations
2. Parking Ramps
3. Swimming pool equipment rooms
4. Chemical storage and hazardous waste storage rooms
5. Sanitary pumping stations
6. Food Service/kitchen areas
7. Walk-in coolers/freezers
8. Locker rooms
9. Greenhouses

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Size, apply and install supports and anchors in compliance with manufacturers recommendations.
- B. Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam 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.
- C. Coordinate hanger and support installation to properly group piping of all trades.
- D. 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.
- E. Perform welding according to standards of the American Welding Society.

3.02 HANGER AND SUPPORT SPACING

- A. Use hangers with minimum vertical adjustment.
- B. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
- C. Support riser piping independently of connected horizontal piping.
- D. Adjust hangers to obtain the slope specified in the piping section of these specification.
- E. Space hangers for pipe as follows:

<u>Pipe Material</u>	<u>Pipe Size</u>	<u>Max. Horiz. Spacing</u>	<u>Max. Vert. Spacing</u>
Cooper	3/4" through 1"	8'-0"	10'-0"
Cooper	1-1/4" through 1-1/2"	10'-0"	10'-0"
Cooper	2" through 3"	12'-0"	10'-0"
Cooper	3-1/2" through 8"	15'-0"	10'-0"
Steel	1" through 1-1/4"	12'-0"	15'-0"
Steel	1-1/2" through 8"	15'-0"	15'-0"
Steel	8" through 12"	15'-0"	20'-0"

- F. Unsupported length from the last hanger and an end sprinkler shall be as follows:

1" piping	Not Greater than 36"
1-1/4" piping	Not greater than 48"

1-1/2" piping or larger Not greater than 60"

3.03 RISER CLAMPS

A. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor. Use method of securing the vertical risers to the building structure below in stairwell locations.

3.04 ANCHORS

B. Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION 21 05 29

SECTION 21 13 16 – DRY PIPE SPRINKLER SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. Applicable provisions of Division 1 shall govern the work under this section.
- B. This section contains specifications for fire protection pipe and pipe fittings for this project.

1.02 RELATED WORK

- A. Section 21 05 00 – Common Work Results for Fire Suppression
- B. Section 21 05 29 – Hangers and Supports for Fire-Suppression Piping and Equipment

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

ANSI A21.4	
ANSI A21.11	
ANSI A21.51	
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI B16.3	Malleable Iron Threaded Fittings
ANSI B16.4	Cast Iron Threaded Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.9	Factory Made Wrought Steel Buttweld Fittings
ANSI B16.11	Forged Steel Fittings, Socket Welded and Threaded
ANSI B16.18	Cast Bronze Solder Joint Pressure Fittings
ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A135	Electric Resistance Welded Steel Pipe
ASTM A181	Forgings, Carbon Steel for General Purpose Piping
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

ASTM A536	Ductile Iron Castings
ASTM A795	Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B88	Seamless Copper Water Tube
AWS A5.8	Brazing Filler Metal
AWS D10.9	Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3
NFPA 13	Installation of Sprinkler Systems. (Latest prevailing addition)
NFPA 14	Installation of Standpipe and Hose Systems. (Latest prevailing addition)
UL	Underwriters' Laboratories Listing
FM	Factory Mutual Approval

1.05 SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures

B. SD-02 Shop Drawings:

1. The fire-suppression contractor is responsible for showing water supply entrance, fire protection riser, standpipes, inspectors test drain lines and large mains requiring space coordination with architectural, HVAC and electrical work. Where branch piping requires similar coordination or specific zoning it should also be shown. Hydraulic sizing is responsibility of fire-suppression contractor. All items identified in NFPA #13 for proper working Drawings shall be complied with. Submittals not in compliance will be rejected.
2. Submit all necessary Shop Drawings to authorities having jurisdiction. Six (6) sets shall be sent to the A/E for review. After approval from jurisdictional agencies have been returned to the Contractor, they shall be submitted to the A/E for final acceptance. These final acceptance sets shall have all agencies' stamps of review and acceptance.
3. Shop Drawings shall be prepared in Auto CAD Version 2004 or compatible software.
4. The preparation of all Shop Drawings and hydraulic calculations shall be prepared by a Registerer Professional Engineer, competent in Fire Protection, licensed in the State of Wisconsin or by a Designer recognized by the state of Wisconsin. As the Shop Drawing and calculation review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial Submittals will not be accepted. Material Submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind Submittals in notebooks or binders and provide index referencing the appropriate Specification Section.

5. Engineer's review will be for general location only. It will be the Fire-Suppression Contractor's responsibility to check his Drawings for interferences and to do shop fabrication from measurements taken at the job site.

C. SD-03 Product Data: Submit six (6) sets of full catalog information shall be submitted for approval for all materials intended for use on this Project. Catalog information indicating more than one item shall be highlighted to clearly indicate the proposed equipment. All equipment and devices shall be of a make and type listed by UL, FM, or other nationally recognized testing laboratory for the specific purpose for which it is used.

D. SD-05 Design Data:

1. Submit hydraulic calculations according to NFPA 13 and with design information given on Drawings.

2. Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.

E. SD-10 Operation and Maintenance Data: Provide Operation and Maintenance Manuals per Art. 32 of the General Requirements.

F. SD-11 Closeout Submittals: Submit Record Drawings prior to project closeout per General Requirements, Art. 37.

1.06 QUALITY ASSURANCE

A. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

B. Installer Qualifications: The Installer shall possess a valid State of Wisconsin Fire Sprinkler Contractor's license and shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past three years. Provide a copy of the installing Contractors fire sprinkler state Contractor's license.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified,

take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.08 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.

C. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

D. Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

E. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

1.09 WELDER QUALIFICATIONS

A. Welding procedures, welders, and welding operators for all building service piping to be according to certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

B. Welder certifications are required to be renewed every three years. If qualification papers are needed on a project, verify that they are current.

C. The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the Owner's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 - PRODUCTS

2.01 FIRE PROTECTION PIPING

A. STEEL PIPE:

1. Black steel pipe welded and seamless, Type F, Grade A, ASTM A53; black welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.
2. Threaded lightwall pipe and plastic pipe are not acceptable.
3. Pipe Wall Thickness: Schedule 40 for welded, rolled groove, cut groove and threaded. Schedule 30 for welded, rolled groove, 8" and larger cut groove and 8" and larger threaded piping. Schedule 10 up to and including 6" for rolled groove and welded. 0.188" for 8" and 10" rolled groove and welded.
4. Fittings: 2" and Under - Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4. Malleable iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3. Standard weight seamless carbon steel weld fittings, ASTM A234 grade, ANSI B16.9. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ASTM A47 malleable iron or ASTM A53 fabricated steel.
5. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
6. Finish: Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used in dry sprinkler or combined pipe systems, pre-action systems, piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or cut groove hot dipped zinc coated pipe ends for fitting connections. Indoor dry standpipe systems supplied by a Fire Dept. connection only may be black steel piping and fittings.

2.02 COPPER PIPE

- #### **A. Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.**

2.03 UNIONS AND FLANGES

A. 2" AND SMALLER STEEL:

1. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.
- B. 2" AND SMALLER COPPER:
1. ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.
- C. 2-1/2" AND LARGER:
1. ASTM A181 or A105, Class 150, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. ANSI B16.1 or ANSI B16.5, Class 150 cast iron threaded flanges. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.
- D. 2-1/2" AND LARGER COPPER:
1. ANSI B16.24, Class 150 cast bronze flanges with raised face.

2.04 MECHANICAL GROOVED PIPE CONNECTIONS

- A. Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Anvil or Star Fittings may be used with steel pipe. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.
1. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer.
 2. Couplings and fittings to be malleable iron, ASTM A47, or ductile iron A536 with painted finish. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.
 3. Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.
 4. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.
 5. Standard flanges are necessary so that the butterfly valve can be properly bolted to the flange and retain its place in the pipe when piping on one side is removed.

6. Credit for the inherent flexibility of mechanical grooved pipe connections when used for expansion joints or flexible connectors may be allowed upon specific application by the Contractor. Three flexible couplings at first three connection points both upstream and downstream of pumps may be used in lieu of flexible connectors. Request for expansion joints shall be made in writing and shall include service, location, line size, proposed application and supporting calculations for the intended service.

2.05 SPRINKLER HEADS

A. Manufacturer: Sprinkler head model numbers establish type and style of head. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted: Central Sprinkler Corporation, Tyco, Reliable, Star Sprinkler, Victaulic and Viking.

B. Fusible link or glass bulb type, cast brass or bronze construction. Provide heads with nominal 1/2" discharge orifice except where greater than normal density requires large orifice.

C. Select fusible link or glass bulb temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (165 degree) fusible link or glass bulb type except at skylights, sealed display windows, unventilated attics and roof spaces, over cooking equipment, adjacent to diffusers, unit heaters, uninsulated heating pipes or ducts, mechanical rooms, storage rooms, or where otherwise indicated.

D. Provide quantity of spare heads as noted below and 1 wrench for each type of head and each temperature range installed. Provide 6 spare heads per 300 or less installed heads, 12 per 1000 or less and 24 for more than 1000. Provide steel cabinet for storage of heads and wrenches.

E. Edit sprinkler head models, types and features for specific applications. Specify guards where mechanical damage is likely. Specify corrosion resistant coating where subject to corrosive atmosphere.

1. Pendant: Star Model SG (QR), chrome plated finish and escutcheon.
2. Upright: Star Model SG (QR), brass finish.
3. Horizontal Sidewall: Star Model SG (QR), chrome plated finish and escutcheon.
4. Vertical Sidewall: Star Model E, chrome finish.

F. Quick Response Pendant: Viking Microfast M, chrome plated finish and escutcheon. The use of quick response heads is now mandatory for all light hazard occupancies, see NFPA rulings, note the "exceptions" listings.

1. Quick Response Sidewall: Viking Microfast M, chrome plated finish and escutcheon.
2. Dry Pendant (Self-contained type): Viking Model C, brass finish with brass escutcheon.
3. Dry Pendant (Self-contained type): Viking Model M (Quick Response), adjustable, recessed, with chromed escutcheon.
4. Dry Horizontal Sidewall (Self-contained type): Viking Model M (Quick response), adjustable, recessed, with chromed escutcheon.
5. Pendant Security: Star PH-2, Style A/B, with sleeve, centering grommet and retainer flange.
6. Horizontal Sidewall Security: Star PH-5, with sleeve, centering grommet and retainer flange.

2.06 FLOW SWITCHES

- A. Vane type waterflow switch with metal enclosure, adjustable pneumatic retard and electrical characteristics compatible with alarm system.

2.07 PRESSURE SWITCHES

- A. Pressure actuated switch with field adjustable settings, metal enclosure and electrical characteristics compatible with alarm system.

2.08 LOCAL ALARM BELL

- A. Weatherproof electric alarm bell with red painted metal housing, mounting base and gong; solenoid operator; weatherproofing o-ring seal and electrical characteristics compatible with alarm system.

2.09 PRESSURE GAUGES

- A. Manufacturer: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.
- B. Cast aluminum, stainless steel or brass case of not less than 3.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale. Include bronze 3-way globe valve with plugged outlet for Fire Inspector's test gauge.

2.10 VALVES

A. Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Victaulic, Viking, and Watts.

2.11 BALL VALVES

A. 2" and smaller: Bronze, 2-piece, threaded or sweat ends, standard port, blowout proof stem, chrome plated ball, glass reinforced seats, UL approved @ 250 psi. Watts No. B-6000 UL.

2.12 GATE VALVES

A. " and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

B. 2-1/2" and larger: Outside screw and yoke gate valves, 175 psig, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

2.13 BUTTERFLY VALVES

A. 2" and smaller: Bronze body butterfly valve, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem.

B. 2" and larger: Cast or ductile iron body butterfly valve, lug style or grooved, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use cap screws for removal of downstream piping while using the valve for system shutoff.

2.14 SUPERVISORY/TAMPER SWITCHES

A. For O S & Y valve or butterfly valve installations, UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

2.15 CHECK VALVES

A. 3" and smaller: Bronze body, threaded end, Y-pattern, regrindable bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.

B. 2-1/2" and larger: Cast or ductile iron body, flanged or grooved ends, bronze trim, bolted cap, renewable bronze seat and disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.

C. Provide 1/2" automatic drip drain on inlet of fire dept. connection check valve.

2.16 SPRING LOADED CHECK VALVES

A. 2" and smaller: Bronze body, threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, 175 psig, teflon seat unless only bronze available.

B. 2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, 175 psig.

2.17 DRAIN VALVES

A. 3/4" min. two or three piece bronze body ball valve; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG, with hose thread outlet and cap.

2.18 DOUBLE CHECK VALVES

A. Manufacturers: Beeco, Cla-Val, Conbraco, Febco, Watts, and Wilkinson.

B. ASSE 1015 double check backflow preventer with 2 independent spring loaded check valves, 2 isolation ball or gate valves with normally open tamper switch with double wire leads, 4 valved test ports. Constructed of bronze or epoxy coated cast iron or stainless steel body with bronze and plastic internal parts, stainless steel springs, silicone rubber valve discs, bronze seats, rated for 175 psig.

2.19 SPECIALTY VALVES

A. Manufacturer: Central Sprinkler Corporation, Grinnell, Reliable, Star Sprinkler, Victaulic and Viking.

2.20 ALARM CHECK VALVES

A. Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal, single hitch pin and latch design. Provide trim for bypass, drain, electric sprinkler alarm switch, pressure gages, precision retarding chamber, drip cup assembly piped to floor or hub drain, fill line attachment with strainer.

2.21 DRY PIPE VALVES

A. Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal, single hitch pin and latch design. Provide trim for air supply, drain, priming level, alarm connections, pressure gages, priming chamber attachment, ball drip valves, drip cup assembly piped to floor or hub drain, fill line attachment with strainer.

2.22 AIR PRESSURE MAINTENANCE DEVICE

A. Automatic control capable of maintaining system air pressure, rated for 175 psig, adjustable air pressure range of 15 to 60 psig, complete with isolation valves, bypass fill valve, pressure regulator or pressure switch and strainer.

2.23 DELUGE VALVES

A. Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal. Provide trim for bypass, drain, electric sprinkler alarm switch, pressure gages, drip cup assembly piped to floor or hub drain, fill line attachment with strainer and push rod chamber assembly. Include dry pilot trim consisting of actuator, air and water pressure gages, low air warning switch, air relief valve and diaphragm actuation device with replaceable bronze seat and resilient diaphragm.

2.24 EMERGENCY PULL BOX

A. 1/2" ball valve in metal enclosure with 1/2" pipe nipple, "Manual Emergency Station" label and breakaway door.

2.25 DELUGE/PREACTION CONTROL

A. Single area (two area or single area cross zoned) type in NEMA 1 enclosure with detector, alarm, power supply, battery charger, standby battery, electrically supervised solenoid valves, polarized fire alarm, lamp test, wiring terminal strip, auxiliary alarm contacts.

2.26 HOSE OUTLET VALVES

A. Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN

2.27 CLASS I AND CLASS III SYSTEMS

A. 2-1/2" (chrome plated) brass angle valve, 300 psig, with removable red handwheel, 2-1/2"x1-1/2" reducing lug pin connector coupling and National Standard male hose thread outlet, cap and chain. Provide N.P.T. female outlet where hose is required.

2.28 CLASS II SYSTEMS

A. 1-1/2" (chrome plated) brass angle valve, 300 psig, with red handwheel and National Standard male hose thread outlet, cap and chain. Provide N.P.T. female outlet where hose is required.

2.29 CLASS III SYSTEMS

A. 2-1/2" (chrome plated) brass angle valve, 300 psig, with red handwheel and National Standard male hose thread outlet, cap and chain.

2.30 FIRE HOSES

A. Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN

B. 100' long, 1-1/2" synthetic lined and jacketed collapsible hose, 500 lb. test, with satin brass nipple and pin lug coupling, satin brass adjustable spray fog nozzle. Provide pivoting red painted steel hose rack with hose pins and collar to secure to hose outlet valve.

2.31 FIRE DEPARTMENT CONNECTION

A. Provide chrome finished 5" Storz FDC per requirements of the City of Sparta Fire Department.

2.32 AIR COMPRESSOR

A. Manufacturer: Quincy, Ingersoll Rand, Nash, and Viking.

B. Multi-Zone and large systems: Simplex electric motor belt driven oil lubricated compressor mounted on ASME rated galvanized receiver tank, pressure operated electric switch, motor, magnetic motor starter with three phase overload protection, fused disconnect switch, safety relief valve, check valve, shutoff valve, pressure gauge, automatic tank drain, intake muffler-filter, belt guard and adjustable operating pressure control.

C. Single zone and small systems: Riser pipe mounted air compressor installation. Electric motor driven, air cooled, oil-less, adjustable, single stage compressor. With check valve, pressure switch, pressure relief valve, mounting bracket kit and air filter assembly. Equal to Viking model E-1.

PART 3 - EXECUTION

3.01 GENERAL

A. Install pipe and fittings according to reference standards, manufacturer's recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of fire protection piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, ceiling grid layout, light fixtures and grilles before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Provide 3/32" min. thickness steel nailing plates behind or on either side of piping where the possibility of penetration from nails or drywall screws exists.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for access to valves and piping specialties.

F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

G. Install piping so that system can be drained. Where possible, slope to main drain valve. Slope dry pipe and pre-action systems subject to freezing at minimum 1/4"/10' on mains and 1/2"/10' on branches. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to grade or to air gap sewer receptor.

H. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

I. Do not route piping within exterior walls.

J. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

1. This requirement is based on NFPA 70, 384-4 and 450-47.
2. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

3.04 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation and assemble joint to socket stop. Apply flame to fitting until brazing alloy melts when placed at joint. Wipe excess alloy from joint.

3.05 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding according to ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used only for connections up to one-half (1/2) the diameter of the immediate upstream piping.

3.06 THREADED PIPE JOINTS

A. Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.07 MECHANICAL GROOVED PIPE CONNECTIONS

A. Use pipe factory grooved according to the coupling manufacturer's specifications or field grooved pipe according to the same specifications using specially designed tools available for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint according to the coupling manufacturer's specifications.

3.08 MECHANICALLY FORMED TEE FITTINGS

A. Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

3.09 UNIONS AND FLANGES

A. Install a union, flange or grooved coupling combination at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union or grooved coupling combination connections on the equipment side of the valve. Concealed unions, flanges or couplings are not acceptable.

3.10 PIPING SYSTEM LEAK TESTS

- A. Conduct pressure test with test medium of water. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.
- B. Test piping in sections or entire system as required by sequence of construction. Do not conceal pipe until it has been successfully tested. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Entire test must be witnessed by the Division's representative.
- C. Use clean water and remove air from the piping being tested where possible. Measure and record test pressure at the high point in the system.
- D. Test system at 200 psi for 2 hours showing no leakage. Where system design is in excess of 150 psig, test at a pressure 50 psig above system design pressure.
- E. All pressure tests are to be documented on NFPA Contractor's Material and Test Certificate forms.

3.11 INSTALLATION

- A. Install fire protection system components according to NFPA rulings, listings and manufacturers recommendations. Locate where accessible for servicing and replacement.
- B. Sprinkler Heads: Locate sprinkler heads as indicated on fire protection plan and reflected ceiling plan maintaining minimum clearances from obstructions, ceilings and walls. Install sprinkler heads level in locations not subject to spray pattern interference. Provide fire sprinkler head installations below ductwork, soffits, etc. **Heads to be centered within ceiling tiles.**
- C. Switches: Locate flow and pressure switches where indicated and where required to obtain specified zoning to isolate floors and major areas of floors. Provide valved test connection for flow switch adjacent to flow switch.
1. Pipe to floor drain. Test flow switch to verify proper operation.
 2. Locations of switches should be shown on drawing for coordination with electrical work.

D. Gauges: Provide a valved pressure gauge in main fire protection riser, at the top of each piping riser, at inlet and outlet of pump and elsewhere as indicated.

E. Valves: Properly align piping before installation of valves. Do not support weight of piping system on valve ends. Mount valves in locations which allow access for operation, servicing and replacement. Install all valves with the stem in the upright or horizontal position. Valves installed with the stems down will not be accepted. Provide a riser shutoff valve and a capped hose thread drain valve at the bottom of each riser. Provide capped hose thread drain valves to allow draining of each portion of piping.

F. Specialty Valves: Install in vertical position fire protection riser. Install trim recommended by manufacturer including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms, pressure maintenance devices, emergency pull boxes and deluge/preaction controls.

G. Hose Outlet Valves: Install at each standpipe outlet and elsewhere where indicated approximately 4' above floor.

H. Fire Department and Fire Pump Test Connections: Mount on wall where indicated. Support from structure independent of piping. Locate between 2' to 3' above grade. Fill wall penetration with insulation and caulk exterior and interior face of wall opening weathertight.

I. Air Compressor: Install on concrete housekeeping pad, leveled and bolted in place. Pipe automatic drain discharge piping to floor drain. Install line size ball valve and check valve in discharge line. Install pressure gauge upstream of ball valve.

END OF SECTION 21 10 00

END OF DIVISION 21 – FIRE SUPPRESSION

DIVISION 22 – PLUMBING

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SECTION 22 05 00 – COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

SCOPE

This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

RELATED WORK

Not Used

REFERENCE

Applicable provisions of Division 1 govern work under this section.

This section applies to all Division 22 00 00 sections of plumbing.

STANDARDS

Abbreviations of standards organizations referenced in this and other sections are as follows:

ABMA	American Boiler Manufacturers Association
ACPA	American Concrete Pipe Association
AGA	American Gas Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASME	American Society of Mechanical Engineers
ASPE	American society of Plumbing Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
CGA	Compressed Gas Association
CS	Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
EPA	Environmental Protection Agency
FS	Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
GAMA	Gas Appliance Manufacturers Association
IAPMO	International Association of Plumbing & Mechanical Officials
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
MCA	Mechanical Contractors Association
MICA	Midwest Insulation Contractors Association
MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
PDI	Plumbing and Drainage Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
STI	Steel Tank Institute
UL	Underwriters Laboratories Inc.

Standards referenced in this section:

ACI 614	Recommended Practice for Measuring, Mixing and Placing of Concrete
ASTM D1557	Standard Test Method for Moisture-Density Relations of Soils
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials

D.O.T.	Standard Specifications for Road and Bridge Construction, State of Wisconsin, Dept. of Transportation
UL1479	Fire Tests of Through-Penetration Firestops
UL723	Surface Burning Characteristics of Building Materials

LEAD FREE REQUIREMENTS

All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$ per the Federal Safe Drinking Water Act as amended January 4th 2011 Section 1417.

This requirement applies to all of the subsequent Plumbing Specification Sections and Plumbing Drawings and supersedes any part or model number that may conflict with this requirement.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

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 for obtaining the intended performance from the system into which these items are placed.

CONTINUITY OF EXISTING SERVICES

Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

PROTECTION OF FINISHED SURFACES

Refer to Division 1, General Requirements, Protection of Finished Surfaces.

SLEEVES AND OPENINGS

Refer to Division 1, General Requirements, Sleeves and Openings.

SEALING AND FIRESTOPPING

Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the

sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

EQUIPMENT FURNISHED BY OTHERS

PROVISIONS FOR FUTURE

OFF SITE STORAGE

Prior approval by DFD and the A/E will be needed. The contractor shall submit Storage Agreement Form AD-BDC-74 to DFD for consideration of off site materials storage. Generally, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for off site storage. No material will be accepted for off site storage unless shop drawings for the material have been approved.

CODES

Comply with requirements of Wisconsin Administrative Code.

REQUEST AND CERTIFICATION FOR PAYMENT

Within 10 days after Notice to Proceed, the successful bidder will submit to the DFD Project Representative in a form prescribed below and by the General Conditions of the Contract - Scheduling and Coordination of Work, Reports, Records and Data, Payments to Contractor, a cost breakdown of the proposed values for work performed which, if approved by DFD, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

CERTIFICATES AND INSPECTIONS

Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer. Deliver the originals of inspection certificates and test records to the Owner's Project Representative. Include copies of the certificates and test records in the Operating and Maintenance Instructions.

SUBMITTALS

Refer to Division 1, General Conditions, Submittals.

Not more than two weeks after award of contract but before any shop drawings are submitted, contractor to submit the following plumbing system data sheet. List piping material type for each piping service on the project, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves and specialties for each piping service, fixture and equipment with manufacturer and model

number. The approved plumbing system data sheet(s) will be made available to the DFD Project Representative for their use on this project.

PLUMBING SYSTEM DATA SHEET

<u>Item</u>	<u>Pipe Service/Sizes</u>	<u>Manufacturer/Model No.</u>	<u>Remarks</u>
Pipe			
Fittings			
Unions			
Valves:			
Ball			
Butterfly			
Balancing			
Check			
Gate			
Curb Stop			
Other			
Pipe Specialties:			
Thermometers			
Press Gauges			
Strainers			
Building Penetrations			
Hangers & Supports			
Insulation			
Plbg. Specialties:			
Floor/Roof Drains			
Cleanouts			
Water Hammer			
Arrestors			
Backflow Preventers			
Wall/Yard Hydrants			
Hose Bibbs			
Trap Primers			
Hydrants			
Valve Boxes			
Manhole Castings			
Wash Machine Boxes			
Plbg. Fixtures			
Plbg. Equipment			

Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:

Operating and Maintenance Manuals	2 copies
Division of Facilities Development	1 copy
Architect/Engineer	1 copy

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. Records of tests performed a to certify compliance with system requirements
2. Manufacturer's wiring diagrams for electrically powered equipment
3. Certificates of inspection by regulatory agencies
4. Valve schedules
5. Lubrication instructions, including list/frequency of lubrication
6. Parts lists for fixtures, equipment, valves and specialties.
7. Manufacturers installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
8. Additional information as indicated in the technical specification sections

TRAINING OF OWNER PERSONNEL

Instruct user agency personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include not less than ____ hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup, operation and shutdown procedures for all equipment. All training to be during normal working hours. Videotape all instructions and provide Owner with copy.

RECORD DRAWINGS

Refer to Division 1, General Requirements, Record Drawings.

PART 2 - PRODUCTS

ACCESS PANELS AND DOORS

LAY-IN CEILINGS

Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are sufficient; no additional access provisions are required unless specifically indicated.

CONCEALED SPLINE CEILINGS

Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Section 09500.

METAL PAN CEILINGS

Removable sections of ceiling tile held in position by a pressure fit will be provided under Section 09500.

PLASTER WALLS AND CEILINGS

16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the item needing service; minimum size is 12" by 12".

IDENTIFICATION**STENCILS**

Not less than 1 inch high letters/numbers for marking pipe and equipment.

ENGRAVED NAME PLATES

White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by W. H. Brady.

SNAP-AROUND PIPE MARKERS

One-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, 3/4" min. size for lettering. Provide nylon ties on each end of pipe markers. Equal to Seton Setmark.

VALVE TAGS

Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains, brass "S" hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, or W. H. Brady.

UNDERGROUND WARNING TAPE

Detectable underground warning tape, 5.0 mil overall thickness, 6" width, .0035" thick aluminum foil core with polyethylene jacket bonded to both sides. Color code tape and print caution along with name of buried service in bold letters on face of tape. Thor Enterprises Magnatec or equal by Carlton, MSI Marking Services, Seton.

UNDERGROUND TRACER WIRE

All underground non-metallic sewers/mains and water services/mains shall be provided with tracer wire installations. Tracer wire installations shall conform with Section 182.0715(2r) of Wisconsin Statutes and prevailing Department of Safety and Professional

Services Chapter 384 requirements. Tracer wire shall be continuous solid copper or steel plastic coated with split bolt or compression-type connectors.

BEDDING AND BACKFILL

Bedding up to a point 12" inches above the top of the pipe shall be thoroughly compacted sand or crushed stone chips meeting the following gradations:

<u>Gradation for Bedding Sand</u>		<u>Gradation for Crushed Stone Chip Bedding</u>	
<u>Sieve Size</u>	<u>% Passing (by Wt)</u>	<u>Sieve Size</u>	<u>% Passing (by Wt)</u>
1 inch	100	1/2 inch	100
No. 16	45 - 80	No. 4	75 - 100
No. 200	2 - 10	No. 100	10 - 25

Backfill above the bedding in lawn areas shall be thoroughly compacted excavated material free of large stones, organic, perishable, and frozen materials.

Backfill above the bedding under existing and future utilities, paving, sidewalks, curbs, roads and buildings shall be granular materials, pit run sand, gravel, or crushed stone, free from large stones, organic, perishable, and frozen materials.

SEALING AND FIRESTOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS

Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco, or approved equal.

All firestopping systems shall be provided by the same manufacturer.

Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.

Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed

system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

NON-RATED PENETRATIONS

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. The operating bolts of the mechanical type seal shall be accessible from the interior of the building.

At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material

PART 3 - EXECUTION

DEMOLITION

Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

All pipe, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the user agency for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

EXCAVATION AND BACKFILL

Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.

Tunnel or remove sidewalk and curb in areas of excavation to the nearest joint. Remove pavements, curbs and gutters to neat and straight lines to the limits of removal. Make sawcut lines parallel to existing joints, or parallel or perpendicular to pavement edges to form a neat patch. Carefully remove remaining pavement within the sawcut area. Leave existing base materials between the area disturbed by the work and the sawcut line undisturbed by the sawcutting, pavement removal, or pavement replacement processes.

Strip topsoil from area to be excavated, free from subsoil and debris, and store for later respreading.

At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.

Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.

Remove surplus excavated materials from site.

Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.

Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions. No adjustment in compensation will be made for adjustments up to two (2) feet above or below the grades indicated on the plans.

Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and ensure there is no disturbance of bearing soil.

Bed pipe up to a point 12" above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

SHEETING, SHORING AND BRACING

Provide shoring, sheet piling and bracing in conformance with the Wisconsin Administrative Code to prevent earth from caving or washing into the excavation. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or, if approved in advance by the engineer, maintained in place until other permanent support approved by the engineer is provided.

DEWATERING

Provide, operate and maintain all pumps and other equipment necessary to drain and keep all excavation pits, trenches and the entire subgrade area free from water under all circumstances. Obtain general permit from the Wisconsin Department of Natural Resources district office for discharge of construction dewatering effluent. Obtain well permit from the Wisconsin Department of Natural Resources district office for dewatering wells discharging more than 70 GPM. Comply with permit requirements.

ROCK EXCAVATION

Remove rock encountered in the excavation to a minimum dimension of six (6) inches outside the pipe. Rock excavation includes all hard, solid rock in ledges, bedded deposits and unstratified masses, all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; which material is so hard or so firmly cemented that in the opinion of the engineer it is not practical to excavate and remove same with a power shovel except after thorough and continuous drilling and blasting. Rock excavation includes rock boulders of 1/2 cubic yard or more in volume.

Rock excavation will be computed on the basis of the depth of rock removed and a trench width 2 feet larger than the outside diameter of the pipe where one pipe is laid in the trench and 3 feet larger than the combined outside diameter where two pipes are laid in the trench. Include 6" pipe and structure bedding in rock excavation. Include rock excavation shown on the plans in the Base Bid.

SURFACE RESTORATION

Completely restore the surface of all disturbed areas to a like condition of the surface prior to the work. Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

Lawns: Topsoil with 4" of clean, friable, fertile topsoil conforming to D.O.T. Section 625, free from debris, lumps, rocks, roots, plants and seeds. Grade surfaces to match adjacent elevations. Rake smooth, free of lumps and debris. Sod with good quality nursery sod conforming to D.O.T. Section 631, be uniform, dense, free from weeds and consist of approximately 60% Kentucky blue grass and the balance perennial rye, fescue and white clover. Place sod with joints staggered and abutting. Maintain lawn areas for one month after installation. Contractor (*user agency*) will be responsible for necessary watering and mowing. Do necessary weeding, repair, reseeding or resodding until uniform catch is obtained.

Curb and Gutter: Concrete curb and gutter conforming to city requirements and D.O.T. Section 601, Type D or L.

Sidewalk and Walkways: Non-reinforced concrete conforming to D.O.T. Section 602, thickness to match existing, cross slope of one-fourth inch per foot, scored into squares approximately equal to width.

Bituminous Concrete Pavements: 4" thick crushed stone base course conforming to D.O.T. Section 304 (excluding 304.2.4) and two pass bituminous concrete pavement conforming to D.O.T. Section 407, first course 1-1/2" binder, second course 1-1/2" surface.

CONCRETE WORK

Cast-in-place concrete within the building will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

Plumbing related cast-in-place concrete on the exterior of the building to be provided by this Contractor in conformance with requirements of Division 3. This includes piping thrust restraints, pipe supports, hydrant supports, manholes, catch basins, grease traps, septic tanks, distribution boxes, valve pits, meter pits, cleanout cover pads, yard hydrant pads, etc.

CUTTING AND PATCHING

Refer to Division 1, General Requirements, Cutting and Patching.

BUILDING ACCESS

Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

EQUIPMENT ACCESS

Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Contractor.

Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

COORDINATION

Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

IDENTIFICATION

Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion.

Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where accessible piping passes through walls or floors. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background.

Identify all exterior buried piping for entire length with underground warning tape except for sewer piping which is routed in straight lines between manholes or cleanouts. Place tape 6"-12" below finished grade along entire length of pipe. Extend tape to surface at building entrances, meters, hydrants and valves. Where existing underground warning tape is broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing tape.

Identify valves with brass tags bearing a system identification and a valve sequence number. Identify medical gas and vacuum valves with brass tags and wall or cabinet mounted color coded engraved nameplate with the following "(Type of Gas) Shutoff Valve for (Location or Zone)". Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device, located in another room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule indicating the valve number and the equipment or areas supplied by each valve and the symbols used for pipe identification; locate schedules in mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed under clear plastic.

LUBRICATION

Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication according to the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

SLEEVES

Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall. In existing poured concrete walls where penetration is core drilled, pipe sleeve is not required.

Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.

Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.

In all piping floor penetrations, fire rated and non-fire rated, top of sleeve shall extend 1 inch above the adjacent finished floor. In existing floor penetrations, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to existing floor structure.

For floor penetrations through existing floors in mechanical and wet locations listed below, core drill opening and provide 1-1/2" x 1-1/2" x 1/8" galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from entering the penetration. Provide urethane caulk between angles and floor and fasten angles to floor a minimum of 8" on center. Seal corners water tight with urethane caulk. Or, core drill sleeve openings large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting non-shrink grout/cement.

Wet locations include:

1. Parking ramps
2. Sanitary pumping stations
3. Swim pool equipment rooms
4. Chemical storage and hazardous waste storage rooms

For pipe penetrations through existing floors in food service areas, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting non-shrink grout/cement. Size sleeve to allow insulated pipe to pass through sleeve and paint the sleeve.

Pipe sleeves are not required in cored floor pipe penetrations through existing floors that are not located in mechanical rooms, food service areas or wet locations listed above.

SEALING AND FIRESTOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS

Install approved product according to the manufacturer's instructions where a pipe penetrates a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.

Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support substantial weight.

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 penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

END OF SECTION 22 05 00

SECTION 22 05 13 – COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 – GENERAL

SCOPE

This sections includes requirements for single and three phase motors that are used with equipment specified in other sections.

RELATED WORK

Section 22 42 00 - Commercial Plumbing Fixtures.

Section 22 30 00 - Plumbing Equipment for equipment requiring motors.

Division 26 00 00 - Electrical - Electrical for power wiring, starters, and other electrical devices

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI/IEEE 112	Test Procedure for Polyphase Induction Motors and Generators
ANSI/NEMA MG-1	Motors and Generators
ANSI/NFPA 70	National Electrical Code

SHOP DRAWINGS

Include with the equipment which the motor drives the following motor information: motor manufacturer, voltage, phase, hertz, rpm, full load efficiency, full load power factor, service factor, NEMA design designation, insulation class, and frame type.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

ELECTRICAL COORDINATION

All starters, disconnects, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are provided by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be made to any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the

architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor.

The A/E must coordinate specified voltages with the Electrical Consultant for the project. The Electrical Contractor will provide all power wiring and the Plumbing Contractor will provide all control wiring. Control wiring shall conform to Division 16 requirements for Control Wiring.

Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

PRODUCT CRITERIA

Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

Furnish motors for starting according to utility requirements and compatible with starters as specified.

PART 2 - PRODUCTS

THREE PHASE, SINGLE SPEED MOTORS

Use NEMA rated three phase, 60 hertz motors for all motors 1/2 HP and larger unless specifically indicated.

Use NEMA general purpose, continuous duty, Design B , normal starting torque, T-frame or U-frame motors with Class B or better insulation unless the manufacturer of the equipment on which the motor is being used has different requirements. Use open drip-proof motors unless totally enclosed fan-cooled, totally enclosed non-ventilated, explosion-proof, or encapsulated motors are specified in the equipment sections.

Use grease lubricated anti-friction ball bearings with housings equipped with plugged/capped provision for re-lubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at the end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

All open drip-proof motors to have a 1.15 service factor. Other motor types may have minimum 1.0 service factors.

All motors 1 HP and larger, except specially wound motors and inline pump motors 56 frame and smaller, to be high efficiency design with full load efficiencies which meet or exceed the values listed below when tested according to NEMA MG 1.

2.02 FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED

Open Drip-Proof Motors <u>MOTOR HP</u>	Nominal Motor Speed		
	<u>1200 rpm</u>	<u>1800 rpm</u>	<u>3600 rpm</u>
1	82.5	85.5	77.0
1-1/2	86.5	86.5	84.0
2	87.5	86.5	85.5
3	88.5	89.5	85.5
5	89.5	89.5	86.5
7-1/2	90.2	91.0	88.5
10	91.7	91.7	89.5
15	91.7	93.0	90.2
20	92.4	93.0	91.0
25	93.0	93.6	91.7
30	93.6	94.1	91.7
40	94.1	94.1	92.4
50	94.1	94.5	93.0
60	94.5	95.0	93.6
75	94.5	95.0	93.6
100	95.0	95.4	93.6
125	95.0	95.4	94.1
150	95.4	95.8	94.1
200	95.4	95.8	95.0

	Totally Enclosed Fan-Cooled Nominal Motor Speed		
	<u>1200 rpm</u>	<u>1800 rpm</u>	<u>3600 rpm</u>
<u>MOTOR HP</u>			
1	82.5	85.5	77.0
1-1/2	87.5	86.5	84.0
2	88.5	86.5	85.5
3	89.5	89.5	86.5
5	89.5	89.5	88.5
7-1/2	91.0	91.7	89.5
10	91.0	91.7	90.2
15	91.7	92.4	91.0
20	91.7	93.0	91.0
25	93.0	93.6	91.7
30	93.0	93.6	91.7
40	94.1	94.1	92.4
50	94.1	94.5	93.0
60	94.5	95.0	93.6

<u>MOTOR HP</u>	Totally Enclosed Fan-Cooled Nominal Motor Speed		
	<u>1200 rpm</u>	<u>1800 rpm</u>	<u>3600 rpm</u>
75	94.5	95.4	93.6
100	95.0	95.4	94.1
125	95.0	95.4	95.0
150	95.8	95.8	95.0
200	95.8	96.2	95.4

SINGLE PHASE, SINGLE SPEED MOTORS

Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller.

Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

TWO-SPEED MOTORS

Unless otherwise indicated, three phase two speed motors to be [one winding, consequent pole, variable torque type] [two winding, variable torque] and single phase motors to be capacitor start capacitor run type having two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

MOTORS USED FOR REDUCED VOLTAGE STARTING

Furnish motors compatible with reduced voltage starting for the following motors:

<u>Equipment</u>	<u>Starter Type</u>

MOTORS USED ON VARIABLE FREQUENCY DRIVES

In addition to the requirements specified above, the motor must be suitable for use with the drive specified, including but not limited to motor cooling.

PART 3 - EXECUTION

INSTALLATION

Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.

When motor will be flexible coupled to the driven device, mount coupling to the shafts according to the coupling manufacturer's recommendations. Using a dial indicator, check angular misalignment of the two shafts; adjust motor position as necessary so that the angular misalignment of the shafts does not exceed 0.002 inches per inch diameter of the coupling hub. Again using the dial indicator, check the shaft for run-out to assure concentricity of the shafts; adjust as necessary so that run-out does not exceed 0.002 inch.

When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts according to the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is according to the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation and again after several days.

Verify the proper rotation of each three-phase motor as it is being wired or before the motor is energized for any reason.

Lubricate all motors requiring lubrication.

END OF SECTION 22 05 13

SECTION 22 05 14 – PLUMBING SPECIALTIES

PART 1 – GENERAL

SCOPE

This section includes specifications for floor drains, roof drains, cleanouts, backflow preventers, water hammer arrestors and other miscellaneous plumbing specialties.

RELATED DOCUMENTS

Section 22 11 00 - Facility Water Distribution

Section 22 13 00 - Facility Sanitary Sewerage

Section 22 14 00 - Facility Storm Drainage

Section 22 05 23 - General-Duty Valves for Plumbing Piping

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS

ANSI A112.14.1	Backwater Valves
ANSI A112.21.1	Floor Drains.
ANSI A112.21.2	Roof Drains.
ANSI A112.26.1/PDI WH-201	Water Hammer Arrestors.
ASSE 1001	Pipe Applied Atmospheric Type Vacuum Breakers.
ASSE 1010	Water Hammer Arrestors.
ASSE 1011	Hose Connection Vacuum Breakers.
ASSE 1012	Backflow Preventers with Intermediate Atmospheric Vent.
ASSE 1013	Reduced Pressure Principle Backflow Preventers.
ASSE 1018	Trap Seal Primer Valves.
ASSE 1019	Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

Plumbing products requiring approval by the State of Wisconsin Dept. of Safety and Professional Services must be approved or have pending approval at the time of shop drawing submission.

SHOP DRAWINGS

Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

PART 2 - PRODUCTS

FLOOR DRAINS

Manufacturer: Josam, Smith, Wade, Watts, Zurn.

FD-1: 3" min. (2" min. for single shower drains) enameled cast iron two piece body with double drainage flange, weep holes, reversible clamping adjustable collar, adjustable 6"x6" min. square or round polished nickel-bronze strainer with threaded collar, bottom outlet. Zurn ZN-415-S or B.

FD-1A: same as FD-1 with the addition of the trap guard diaphragm called out below.

FD-2: 4" enameled heavy duty cast iron two piece body with double drainage flange, weep holes, heavy duty adjustable 9" round coated cast iron tractor grate strainer, with sediment bucket, bottom outlet. Zurn Z-556-Y.

FD-2A: same as FD-2 with the addition of the trap guard diaphragm called out below.

FD-3: 4" enameled heavy duty cast iron two piece body with double drainage flange, weep holes, heavy duty adjustable 9" round coated cast iron tractor grate strainer, with sediment bucket, with 6" round coated cast iron funnel, bottom outlet. Zurn Z-556-Y / Z-328.

FD-3A: same as FD3 with the addition of the trap guard diaphragm called out below.

FD-4: 4" enameled extra heavy duty cast iron two piece body with seepage pan , weep holes, heavy duty adjustable 13" square top, secured coated cast iron tractor grate strainer, sediment bucket, bottom outlet. Zurn Z676-Y-VP.

FD-4A same as FD-4 with the addition of the trap guard diaphragm called out below.

FD-5: 3" min. scupper drain, 6" x 7" size, cast iron body, rear outlet reversible to bottom outlet, secured flush grate, with flashing clamp. Zurn Z-187-FG.

Trap Guards

Manufacturer: ProSet Systems Trap Guard, JR Smith Quad Close, Sure Seal or approved equal.

Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, hub drains, and trench drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4" size.

FLOOR SINKS

Manufacturer: Josam, Smith, Wade, Watts, Zurn.

FS-1: 4" deep cast iron body, 8" x 8" x 6" deep with white epoxy enameled coated interior and square slotted medium duty top grate, with aluminum interior bottom dome strainer, with anchor flange and/or seepage holes and clamping collar for above grade installation. Zurn Z-1910 (KC)

HUB DRAINS

Manufacturer: Josam, Smith, Wade, Watts, Zurn.

HD-1: 3" min. cast iron hub section up 2" min. above floor level, with full-sized P-trap.

HD-1A: same as HD-1 with the addition of the trap guard diaphragm called out above.

HD-2: 3" min. enameled cast iron bottom outlet floor drain body with membrane clamp, adjustable collar and 3" high extension adapter (less threads on inlet). Zurn Z-415-U (modified). (For use on above grade installations.).

HD-2A: same as HD-2 with the addition of the trap guard diaphragm called out above.

HD-3: same as HD-2 except with the addition of a ball float type backwater valve. Zurn Z-415-U (modified) / Z-1099 (no-hub).

ROOF DRAINS

Manufacturer: Josam, Smith, Wade, Watts, Zurn.

RD-1: 4" min. bottom outlet roof drain, enameled cast iron body with flashing collar and gravel stop, cast iron dome strainer, adjustable extension, underdeck clamp, 15" diameter. Zurn ZC-100-C-EA

RD-2: 4" min. side outlet roof drain, enameled cast iron body with flashing collar and gravel stop, cast iron dome strainer, adjustable extension, underdeck clamp, 15" diameter. Zurn ZC-100-90-C-EA.

RD-3: 4" min. bottom outlet deck drain, enameled cast iron body with flashing collar and secured vandal-proof heavy duty polished bronze heel-proof grate, 14" x 14" square, adjustable extension, underdeck clamp. Zurn ZB-150-C-EA-VP.

TRENCH DRAINS

Manufacturer: Aco, Josam, Neenah, Smith, Tyler, Watts, Zurn.

TD-1: Modular precast polymer concrete, cast iron or polyester fiberglass trench sections with presloped 4" wide radiused interior waterways, knockouts, endcaps, cast iron frame and slotted ductile iron grate, extra heavy duty rated, stainless steel grate holdowns.

CLEANOUTS

Manufacturer: Josam, Smith, Wade, Watts, Zurn.

INTERIOR CONCRETE FLOOR AREAS

Enameled cast iron body with round or square adjustable scoriated polished nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400- / ZN-1400-T.

INTERIOR CERAMIC TILE FLOOR AREAS

Enameled cast iron body with square adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400-T.

INTERIOR VINYL TILE FLOOR AREAS

Enameled cast iron body with round adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400.

INTERIOR CARPETED FLOOR AREAS

Enameled cast iron body with round adjustable scoriated nickel bronze cover and secured carpet marker, tapered threaded ABS closure plug. Zurn Z-1400-CM.

INTERIOR FINISHED WALL AREAS

Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Zurn Z-1446- (Note: Screw shall not pass completely through the ABS plug, trim screw as necessary)

INTERIOR EXPOSED VERTICAL STACKS

Line type cleanout tee with tapered threaded ABS closure plug. Zurn Z-1445.

INTERIOR HORIZONTAL LINES

Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.

EXTERIOR PAVED AREA

Cast iron hub or plug with tapered threaded ABS or PVC closure plug, cast iron frost sleeve and cover set in 24" square by 4" min. thick reinforced concrete pad top or surrounding pavement, crowned for drainage. Neenah R-1976 with non-ferrous securing screw.

EXTERIOR UNPAVED AREAS

Cast iron hub or plug with tapered threaded ABS or PVC closure plug, cast iron or PVC frost sleeve and cover set in 24" square by 4" min. thick reinforced concrete pad top. Neenah R-1976 with non-ferrous securing screw.

BACKWATER VALVES

Manufacturers:, Josam 67500, Smith 7012, Watts BV-200, Zurn Z1090.

Hub and spigot or No-Hub inlet and outlet cast iron body, cast iron gasketed bolted access cover, bronze valve. Flapper to hang in closed position during non-operation period.

SUBSOIL DRAIN TILE RECEIVERS

Manufacturers: Josam, Schier, Smith, Zurn.

Cast iron or polyethylene body with 3 inlets, single lowered outlet, minimum 6" diameter cleanout riser and cleanout top as noted above. Cover unused inlets with water tight caps. Where receiver connects directly to the storm building drain, provide accessible backwater valve.

WATER HAMMER ARRESTORS

Manufacturer: PPP Industries, Sioux Chief, Wade, Watts.

ANSI A112.26.1, ASSE 1010; sized according to PDI WH-201, precharged piston type constructed of hard drawn Type K copper, threaded brass adapter, brass piston with o-ring seals, FDA approved silicone lubricant, suitable for operation in temperature range 35 to 150 degrees F, maximum 250 psig working pressure, 1500 psig surge pressure. Watts series 15.

BACKFLOW PREVENTERS

Manufacturers: Beeco, Cla-Val, Conbraco, Febco, Watts, Wilkins.

HOSE CONNECTION VACUUM BREAKERS

ASSE 1011, brass or bronze construction, EPDM diaphragm and seat, rated for 125 psig and 180°F. Watts 8 (interior application).

LAB FAUCET VACUUM BREAKERS

ASSE 1035, brass or bronze construction, chrome plated, EPDM diaphragm and seat, stainless steel internals, rated for 125 psig and 160°F. Watts NLF9.

PIPE APPLIED ATMOSPHERIC TYPE VACUUM BREAKERS

ASSE 1001, same size as pipe, brass or bronze construction, silicone disc, rated for 125 psig and 160°F. Watts 288A.

ANTI-SIPHON PRESSURE TYPE VACUUM BREAKERS

ASSE 1020, same size as pipe, brass or bronze construction, silicone disc, plastic seat, stainless steel spring, inlet and outlet ball shutoff valves, test port ball valves, rated for 150 psig and 110°F. Watts 800M4QT

HIGH HAZARD ANTI-SIPHON, ANTI-SPILL VACUUM BREAKERS

ASSE 1056, same size as pipe, brass or bronze construction, silicone rubber discs, stainless steel springs, inlet and outlet ball shutoff valves, with test cocks, anti-spill design, rated for 150 psig and 180 deg. F max.. Watts 008QT.

DUAL CHECK WITH ATMOSPHERIC VENT FOR CO₂ POST MIX VENDING MACHINES

3/8", stainless steel body and parts, dual check with third ball check outlet, rated for 150 psig and 140°F. Watts 9BD.

INTERMEDIATE ATMOSPHERIC VENTED BACKFLOW PREVENTERS

ASSE 1012, same size as pipe, with intermediate atmospheric vent between independent check valves, bronze body with union ends, stainless steel springs, rated for 175 psig and 210°F. Watts 9DM.

REDUCED PRESSURE ZONE BACKFLOW PREVENTERS

ASSE 1013_ " reduced pressure zone backflow assembly complete with inlet strainer, inlet and outlet ball or non-rising stem gate isolation valves. Size for maximum pressure drop of ___ psig at ___ GPM. Constructed of bronze or epoxy coated cast iron body with bronze and plastic internal parts, stainless steel springs, non-threaded vent outlet, 4 test cocks, rated for 175 psig and 210°F, with air gap apparatus on drain. Watts series 919-S-QT-AG, Wilkins #975 or approved equal.

WALL HYDRANTS

Manufacturer: Josam, Smith, Wade, Watts, Woodford, Zurn.

WH-1: Freezeproof automatic draining wall hydrant with exposed chrome plated bronze wall plate, 3/4" inlet, 3/4" hose thread ASSE 1019-93 backflow preventer outlet, copper or bronze casing, loose key operator. Woodford model 65 series

WH-2: Freezeproof automatic draining wall hydrant in flush mounted cast brass wall box with locking door, 3/4" inlet, 3/4" hose thread ASSE 1019-93 backflow preventer outlet, loose key operator, polished brass finish. Woodford model B65, RB65, B67 or RB67 series.

YARD HYDRANTS

Manufacturer: Woodford, or approved equal.

YH-1: Freezeproof / Pollution-proof post-type, with below-ground reservoir yard hydrant with locking handle, 1" inlet, 3/4" hose thread, ASSE 1052 backflow preventer outlet, 1-1/4" galvanized steel casing pipe, schedule 80 PVC pipe reservoir, teflon packing, flow-finder flow plunger. Woodford Model S3-BFP or S4-BFP.

HOSE BIBBS

HB-1: Bronze or brass construction hose faucet/valve, cast iron handwheel, replaceable disc, hose thread spout, with ASSE 1011 backflow preventer outlet, 3/4" size. Watts model SC-8-3.

TRAP PRIMER VALVES

Manufacturers: Ancon, PPP Industries, Smith, Watts.

Bronze body, O-ring seals, integral threaded outlet vacuum breaker, adjustable, in conformance with ANSI/ASSE 1018. PPP model P-1/P-2.

FIRE HYDRANTS

Manufacturer: Clow, Kennedy, Mueller, Waterous.

FHY: AWWA C502 dry barrel hydrant with cast or ductile iron body and standpipe, two field replaceable 2-1/2" hose nozzles and chained caps, one field replaceable pumper nozzle and chained cap, 5-1/4" compression valve, O-ring seals, sealed oil reservoir, breakaway safety flange and stem coupling, automatic bronze drain valve, red finish, 6'-0" min. bury depth. Verify thread requirements with the local fire department or authority having jurisdiction.

VALVE BOXES

Manufacturer: C.P. Test Service, Mueller, Tyler.

Two-piece cast iron adjustable height casing with cast iron frame, cast iron cover and bottom bearing flange. Size for full burial depth of valve. 2" minimum internal diameter for valves sizes through 2", 4" minimum internal diameter for valve sizes 2-1/2" through 3" and 5-1/4" minimum diameter for 4" and larger valves. Cast name of service on cover top. On plastic pipelines, provide cast iron foot piece matched to valve box bottom or concrete bearing pad for support of valve.

MANHOLES AND CATCH BASINS

Precast reinforced concrete manhole sections, 48" diameter minimum manholes, 36" diameter minimum catch basins, ASTM C478. Construct base of 6" thick precast reinforced concrete or 8" thick cast in place concrete. Construct top of precast reinforced concrete eccentric cone and adjusting rings or 6" thick reinforced concrete slab with concentric opening.

Seal between sections with rubber ring gaskets, ASTM C443, or plastic preformed gasket material. Seal pipe penetrations with flexible watertight rubber gasketed seals.

Steps to be constructed of cast iron or polypropylene coated steel reinforcing rod.

Frame and cover or grate to be cast iron, ASTM A48, Class 35B, of style indicated, with minimum 24" diameter manhole opening, 20" diameter catch basin opening and pickhole. Provide gasketed self-sealing covers on sanitary manholes.

SAFINGS

Manufacturers: Noble, Oatey.

Chlorinated polyethylene sheeting, 40 mils thick, ASTM D4068, joined with CPE solvent; or 3 lb./sq. ft. sheet lead.

VENT FLASHINGS

Manufacturers: Semco, Oatey.

Formed 3 lb./sq. ft. lead flashing with minimum base size of 15"x17".

Single Ply Membrane Roofs: Flashing boot of material compatible with roofing membrane with base flange for adhering to membrane and stainless steel drawband for securing to vent pipe.

WASHING MACHINE WALL BOXES

Manufacturers: Acorn, Bradley or approved equal.

AWC-1: Type 304 satin finish stainless steel construction recessed supply and waste outlet box for automatic washer connections. With wall flange, anchor clips, cartridge type wheel handle operated valves, screwdriver stops, 3/4" hose outlets, 2" waste outlet, with vacuum breakers, 8-5/8" x 8-5/8" x 3-5/8" D. Acorn Mdl. #8186.

Manufacturers: Guy Gray, Oatey.

AWC-1: Epoxy paint coated steel recessed wall box with face flange, overflow lip, fastening tabs, 1/2" hot and cold bronze washing machine 1/4 turn shutoff valves rated for 125 psi and 180 degrees F, long shank valve fittings for replacement of valves within box, 2" drain outlet fitting. Oatey no 38934.

PART 3 - EXECUTION

3.01 INSTALLATION

Coordinate location and setting of plumbing specialties with adjacent construction. Install according to manufacturers recommendations.

Set floor drains, roof drains, trench drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses or rooms with excessive positive or negative pressure.

Floor drains and hub drains installed in public restrooms, locker rooms, seldom used rooms, and areas with minute drainage flow shall have installations of combination trap evaporation/backflow preventer diaphragm installations.

Set backwater valves on undisturbed soil or compacted granular backfill, level and plumb with top adjusted to finished floor elevation. Test and adjust valve for proper operation. Allow minimum 18" clearance for servicing.

Install subsoil drain tile receivers where indicated. Adjust receiver height to drain tile inlet and outlet elevations and cleanout to finished floor elevation. Secure subsoil drain tile with mechanical or solvent weld connections. Backfill with granular material.

Install water hammer arrestors where indicated and at quick closing valve installations.

Install backflow preventers according to Wis. Dept. of Safety and Professional Services requirements maintaining minimum clearance distances for servicing and testing. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.

Install lab faucet vacuum breakers with Loctite 242 "blue" on threads.

Where backflow preventers requiring Dept. of Safety and Professional Services registration are installed, provide initial registration, testing and report filing required by Dept. of Safety and Professional Services. List the name and address of the building that the backflow preventer installations occur in.

Mount wall hydrants recessed in exterior wall construction with valve plug extended beyond interior side of building insulation. Slope to drain to exterior. Install so discharge is 18" min. above finished grade. Set wall box in grout or caulk and fill exterior wall penetration with insulation.

Mount yard hydrants with discharge 27" min. above finished grade. Set base of hydrant in 1 cu. yd. of granular backfill material for free drainage. Crown finished grade materials for drainage away from hydrant.

Mount hose bibbs securely fastened to wall where indicated. Provide water hammer arrestor in line to hose bibb.

Set fire hydrants level and plumb. Secure hydrant base and back with poured concrete thrust blocking providing thrust restraint and support of hydrant independent of piping. Provide 1 cu. yd. of granular backfill material around drain valve openings for free drainage. Provide isolation valve and valve box at each hydrant. Where hydrant is located in paved area or near traffic, provide 6" diameter by 8' long Schedule 40 painted steel pipe bollards filled with concrete around hydrant.

Set valve boxes level and plumb centered over valve. Set bottom flange on undisturbed soil or compacted granular backfill. Where plastic piping is used, provide cast iron or concrete bearing pad below valve. Adjust top section to finished grade level.

Excavate for manholes and catch basins setting precast bases on granular backfill and pouring cast in place bases on undisturbed soil. Seal joints between base, sections, collars and castings with gasketing material for tightly packed waterproof seals. Adjust casting to match finished grade. Form interior shelves with concrete grout for smooth flowlines conforming to the shape and slope of the sewer. Place piping into manholes providing full support of piping on exterior bedding and insuring pipe seals are properly installed and waterproof. Valve manholes and other manholes intended to remain dry must be made waterproof and are subject to infiltration testing. Where an entering sewer is 2 feet or more above the springline of a leaving sewer, provide outside drop connection encased in concrete. Where existing pipe penetrations are being removed or capped, fill opening with non-shrink Portland cement grout plug. Backfill and compact soil around manhole or catch basin.

Install safig at floor drains above grade. Extend 12" beyond drains in all directions. Cover entire floor in showers and extend 6" up in walls above curbs and to a height of 6' (3" wide each direction) in corners. Install on concrete floor that is smooth and free of debris. Seal all joints and connect to drain body clamp. Safing is subject to standing water leak test. Install safing at all built-up shower installations. (Note: spray-on and brush applied liquid safing is not acceptable).

Flash vent penetrations through roof. Turn down top of lead flashing into vent pipe. Tighten drawband of membrane boot to vent pipe. Adhere base flashing to deck or membrane. Provide waterproof patch around penetration on existing roofs.

Install washing machine boxes in wall construction, secured to structure, directly behind proposed washing machine location. Provide water hammer arrestors in supply piping. Mount box a min. of 36" above floor.

END OF SECTION 22 05 14

SECTION 22 05 15 – PIPING SPECIALTIES

PART 1 – GENERAL

SCOPE

This section contains specifications for plumbing piping specialties for all piping systems.

RELATED WORK

Section 22 11 00 - Facility Water Distribution

Section 22 13 00 - Facility Sanitary Sewerage

Section 22 14 00 - Facility Storm Drainage

Section 22 05 23 - General-Duty Valves for Plumbing Piping

Section 22 07 00 - Plumbing Insulation
Section 22 30 00 - Plumbing Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM B650 Electrodeposited Engineering Chromium Coatings on Ferrous Substrates

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

SHOP DRAWINGS

Required for all items in this section. Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

All piping specialties are to be rated for the highest pressures and temperatures in the respective system according to ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

PART 2 - PRODUCTS

THERMOMETERS

Ashcroft, Marsh, Taylor, H. O. Trerice, Ametek/U. S. Gauge, Weiss, Wika, Weksler.

Stem Type: Cast aluminum case, nine inch scale, clear acrylic window. adjustable angle brass stem with stem of sufficient length so the end of the stem is near the middle of a pipe without reducing the thickness of any insulation, red indicating fluid, black lettering against a white background, with scale ranges as follows:

Service	Hot Water
Scale Range, °F	30 - 180
Increment, °F	2

THERMOMETER SOCKETS

Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

TEST WELLS

Similar to thermometer sockets except with a brass cap that threads into the inside of the test well to prevent dirt from accumulating. Secure cap to body with a short chain. Furnish with extension necks, where appropriate, to accommodate the pipeline insulation.

TEST PLUGS

Brass threaded pressure and temperature test plug with neoprene self-closing valve, valve retainer, brass threaded cap, rated for 150 psi and 0-200 degrees F.

PRESSURE GAUGES

Ametek/U. S. Gauge, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Wika, Weksler.

Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale, with scale range as follows:

Service	Hot Water	Cold Water	Compressed Air
Scale Range, psig	0-100	0-100	0-200
Increment, psig	1	1	2

Pressure Snubbers: Bronze construction, 300 psig working pressure, 1/4" size.

Gauge Valves: Use ball valves as specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.

STRAINERS

Armstrong, Illinois, Keckley, Metraflex, Mueller Steam, Sarco, Watts.

Y type; cast bronze body, ASTM B62; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; sweat, threaded or flanged body rated at not less than 150 psi WOG.

Y type; cast iron body, ASTM A126; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded or flanged ends; rated at not less than 150 psi WOG.

PART 3 - EXECUTION

THERMOMETERS

Stem Type: Install in piping systems as indicated on the drawings and/or details using a separable socket in each location.

THERMOMETER SOCKETS

Install at each point where a thermometer or temperature control sensing element is located in a pipeline.

TEST WELLS

Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for inserting a thermometer at a later date.

TEST PLUGS

Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for short-term measurement of pressure or temperature.

PRESSURE GAUGES

Install in locations where indicated on the drawings and/or details, with scale range appropriate to the system operating pressures.

Pressure Snubbers: Install in gauge piping for all gauges used on water services.

Gauge Valves: Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.

STRAINERS

Install all strainers where indicated allowing sufficient space for the screens to be removed. Install a ball valve in the tapped screen retainer.

END OF SECTION 22 05 15

SECTION 22 05 23 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

SCOPE

This section includes valve specifications for all Plumbing systems except where indicated under

RELATED WORK

Section 22 05 14 - Plumbing Specialties

Section 22 30 00 - Plumbing Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

SUBMITTALS

Schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

ANSI Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

Where valve types (ball, butterfly, etc.) are specified for individual plumbing services (i.e. domestic water, gas, etc.), each valve type shall be of the same manufacturer unless prior written approval is obtained from the Owner.

Valves to be line size unless specifically noted otherwise.

PART 2 - PRODUCTS

WATER SYSTEM VALVES

All water system valves to be rated at not less than 125 water working pressure at 240 degrees F unless noted otherwise.

BALL VALVES

3" and smaller: Two or three piece bronze body; sweat ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation. Apollo 70-200, Jomar T/S 100, Hammond 8511, Milwaukee BA150, Nibco S580-70, Watts B-6001.

BUTTERFLY VALVES

2-1/2" and larger: Cast or ductile iron body; stainless steel shaft; bronze, copper or teflon bushings; EPDM resilient seat; EPDM seals; bronze, aluminum-bronze, EPDM encapsulated ductile iron or stainless steel disc. 200 psig WOG through 12", 150 psig WOG through 24". Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use tapped lug type valves with stud bolts or cap screws, or grooved end connection valves, permitting removal of downstream piping while using the valve for system shutoff. Centerline LT series, DeZurik 632, Hammond 6200 Series, Milwaukee M or C Series, Nibco LD2000/LC2860, Victaulic 300/608/700/709, Watts BF-03.

Provide 10 position locking lever handle actuators for valves 6" and smaller. Provide worm gear operators with external position indication for valves 8" and larger.

SWING CHECK VALVES

3" and smaller: Bronze body, sweat ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Crane 1342, Hammond IB941, Nibco S413B, Watts CVYS, Jomar, Apollo and Milwaukee equals.

4" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward. Crane 373, Hammond IR1124, Milwaukee F2974, Nibco F918B, Watts Series 411, Apollo equal.

SPRING LOADED CHECK VALVES

2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available. ConBraCo 61 series, Mueller 203BP, Nibco S480Y, Val-Matic S1400 series, Watts equal.

2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. APCO 300 or 600 series, Centerline CLC with full body option, Hammond IR9354, Milwaukee

1800 series, Mueller Steam 101AP or 105AP, Nibco W910 or F910, Val-Matic 1400 or 1800 or 8000 series.

STOP & WASTE VALVES:

1" and smaller, Bronze body, sweat or threaded ends, 400 psi WOG, stainless steel ball and stem, full port ball valve, with threaded drain cap, Watts B-6300/6301 SS series. Apollo, Jomar Hammond, Milwaukee or Nibco manufacturer.

BALANCE VALVES

2" and smaller: Two or three piece bronze body ball valve, sweat or threaded ends, chrome plated brass ball, glass filled teflon seat, threaded packing nut, with adjustable memory stop position indicator and extended handle stem, suitable for 400 psig water working pressure at 240 degrees F. Watts B-6000/B-6001 BS Apollo, Grinnell, Hammond, Jomar, Milwaukee Or Nibco manufacturer.

DRAIN VALVES

3/4 inch ball valve with integral threaded hose adapter, sweat or threaded inlet connections, with threaded cap and chain on hose threads, Watts B-6000-CC/B-6001-CC series.

BURIED WATER SERVICE GATE VALVES

Cast iron body, resilient elastomer coated cast iron disc, permanently lubricated stuffing box, bronze non-rising stem and stem nut, double O-ring stem seal, Delrin thrust bearings, electroplated nuts and bolts, cast iron operating nut, AWWA C509, rated for 200 psi. Coat valve inside and out with fusion bonded epoxy, AWWA C550. Clow F-6100, Kennedy 1571, Mueller A-2360, Waterous 500, Watts 406RW.

UNDERGROUND WATER SERVICE BUTTERFLY VALVES

Rubber-seated butterfly valve meeting the requirements of AWWA C504, for Class 150B. Body and disc shall be constructed of cast iron. Disc shall be lens shaped.

Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Disc shall be provided with a stainless steel disc edge.

Valve stem shall be stainless steel. Packing shall be permanent duty "chevron V-type" or "O-ring" type. Bearings shall be permanent, non-metallic, and self-lubricating.

Valve seat shall be a single piece of elastomeric material that is not penetrated by the valve shaft.

Provide manual operator that is suitable for underground service and includes a standard 2" square operating nut.

Valve shall be provided with mechanical joint connections.

Mueller, Clow, Henry Pratt, or approved equal.

CORPORATION STOP VALVES

2" and smaller: Bronze body ground key valve, bronze plug, AWWA taper thread inlet and copper flare outlet nut connections or compression type, AWWA C800.

CURB STOP VALVES

2" and smaller: Bronze body plug valve, bronze plug, quarter turn check, O-ring seals, copper flare nut connections or compression type, AWWA C800.

VALVE BOXES

GATE/BUTTERFLY VALVE BOXES

Valve boxes shall be 5 1/4", cast iron valve boxes. Boxes shall be threaded, three-piece design with stay-put "WATER" cover. Provide appropriately sized bonnet.

Provide valve box extensions as necessary to accommodate depth of cover shown on plans, or 6.5' minimum.

Valve boxes shall be Tyler, or approved equal.

CURB STOP BOXES

Curb stop boxes shall be 1 1/4" minimum diameter, cast iron, arch style, valve boxes. Boxes shall be telescopic, extendable to accommodate 7' bury. Lid shall be two piece threaded, with a plug having a pentagonal bolt for removal.

Ford, Mueller, or approved equal.

PURE WATER VALVES

DIAPHRAGM VALVES

2" smaller, polypropylene type 1 homopolymer construction ASTM D-4101 and D-2146, butt fusion or spigot ends, rated 150 psi at 68 deg. F, PTFE/Teflon diaphragm seals with EDPM backing, wheel handle operated. George Fischer type 315 or equal.

2-1/2" thru 4", polypropylene type 1 homopolymer construction ASTM D-4101 and D-2146, flanged connections, rated at 150 psi at 68 deg. F, PTFE/Teflon diaphragm seals with EDPM backing, wheel handle operated. George Fischer type 317 or equal.

CHECK VALVES

2" and smaller, three piece body, ball check type, polypropylene type 1 homopolymer construction ASTM D-4101 and D-2146, fusion socket, rated 150 psi at 68 deg. F. George Fischer type 360 or equal.

Polypropylene valves, unions, flanges, fittings to be constructed of same materials as pipe and fittings and compatible with the piping installed in the system.

WASTE SYSTEM VALVES

GATE VALVES

2" and smaller: Bronze body, bronze trim, threaded ends, solid wedge, rising stem, union bonnet, malleable iron hand wheel, suitable for 300 psi WOG. Crane 431UB, Hammond IB629, Lunkenheimer 3151, Milwaukee 1151(M), Nibco T134, Powell 2714, Stockham B120.

2-1/2" and larger: Iron body, bronze trim, bolted bonnet, O.S. & Y., solid wedge, flanged, suitable for 200 psi WOG. Crane 465-1/2, Hammond IR1140, Lunkenheimer 1430, Milwaukee F2885, Nibco F617-O, Powell 1793, Stockham G623.

BALL VALVES

3" and smaller: Two or three piece bronze body; sweat or threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG. Apollo 70-200, Hammond 8511, Milwaukee BA150, Nibco S585-70, Watts B-6001.

SWING CHECK VALVES

1-1/2" and smaller: Bronze body, threaded ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Crane 1342, Hammond IB941, Nibco S413B, Watts CVYS.

2" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, outside lever and weight or spring, suitable for installation in a horizontal or vertical line with flow upward. Crane 383, Milwaukee F2974, Nibco F918B.

SPRING LOADED CHECK VALVES

2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available. ConBraCo 61 series, Mueller 203BP, Nibco S480Y, Val-Matic S1400 series.

2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. APCO 300 or 600 series, Centerline CLC with full body option, Hammond IR9354, Milwaukee 1800 series, Mueller Steam 101AP or 105AP, Nibco W910 or F910, Val-Matic 1400 or 1800 or 8000 series.

NATURAL GAS SYSTEMS

SHUT-OFF VALVES

4" and smaller: Ball or eccentric plug valve, bronze or cast iron body, 2" and under threaded ends, 2-1/2" and over flanged ends, chrome plated bronze ball, bronze or nickel plated cast iron plug, TFE or Hycar seats and seals, lever handle, 175 psi W.O.G., U.L. listed for use as natural gas shut-off. Apollo 80-100, DeZurik 425, Milwaukee, Nibco and Watts equals.

5" and larger: Cast iron body, flanged ends, stainless steel bearings, resilient faced plugs, totally enclosed hand wheel actuators, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.

EXTERIOR BELOW GRADE SHUT-OFF VALVES

lug or ball valve, body of same polyethylene type as piping system, pipe stub ends, high strength plastic stem and operating nut, position indicator, polyethylene plug or polypropylene ball, Buna-N seats and double stem seals, rated for 96 psi natural gas service (150 psi non-lethal service).

GAS PRESSURE REGULATORS

2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20 degrees F to 150 degrees F.

COMPRESSED AIR SYSTEMS SHUT-OFF VALVES

3" and smaller: Two or three piece bronze body; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Apollo 70-100, Milwaukee BA100, Nibco T585-70 or T-590-Y, Watts B-6000.

SAFETY EXHAUST SHUT-OFF VALVES

3" and smaller: Two or three piece bronze body; threaded ends, chrome plated bronze ball; downstream vent port; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 175 psig WOG. Apollo 70-100-41, Watts B-6000, Milwaukee or Nibco equals.

PRESSURE REDUCING VALVES

Bronze or aluminum body and trim, diaphragm or balanced piston, 250 psig maximum, 0-125 psig adjustable output, internal relief, 1/4" outlet gauge tapping.

SPECIALTY VALVES AND VALVE ACCESSORIES GAUGE VALVES

Use 1/4" ball valves. Needle valves and gauge cocks will not be accepted.

WATER PRESSURE REDUCING VALVES

Bronze body, diaphragm operated, with an integral thermal expansion bypass valve, inlet union, stainless steel strainer, renewable monel or stainless steel seat and adjustable reduced pressure range, 300 psig at 160 degrees F. Pre-set for the scheduled pressure. A. W. Cash, Conbraco, Watts, Wilkins.

SAFETY RELIEF VALVES

Bronze body, temperature and pressure actuated, stainless steel stem and spring, thermostat with non-metallic coating, test lever, suitable for 125 psig water working pressure at 240 degrees F, sized for full BTUH input and operating pressure of equipment, with valve capacity on metal label. For equipment less than or equal to 200,000 BTUH

input, provide AGA, UL or ASME listed and labeled valve. Provide ASME listed and labeled valve for larger equipment. Bell & Gossett, A. W. Cash, Conbraco, Watts, Wilkins. Temperature and pressure relief valve shall be sized per AGA rating for BTUH input, Re: COMM 82.40(5)(d).

SEWER AIR AND VACUUM VALVES

Combination air release/air and vacuum valve consisting of cast iron elongated body; ___" threaded inlet and ___" outlet; stainless steel valve, trim and float; Hycar or Buna-N rubber seat; inlet, backflushing and blowoff valves; 5' backflushing hose with quick disconnect fittings; 150 psig. Apco Series 440 SCAV, Crispin S20A/S20 Series, Val-Matic 800 Series.

PART 3 - EXECUTION

GENERAL

Properly align piping before installation of valves. Install and test valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

Mount valves in locations which allow access for operation, servicing and replacement.

Provide valve handle extensions for all valves installed in insulated piping.

Install all valves with the stem in the upright or horizontal position. If possible, install butterfly valves with the stem in the horizontal position. Valves installed with the stems down will not be accepted.

Prior to flushing of piping systems, place all valves in the full-open position.

SHUT-OFF VALVES

Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair and elsewhere as indicated.

BALANCING VALVES

Install where indicated on the drawings and details for balancing of flow in pumped hot water recirculation piping systems.

Upon project completion, adjust each valve and set position stop. Balance system to minimum flow in return piping branches needed to maintain even supply water temperature throughout building.

DRAIN VALVES

Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, downstream of riser isolation valves, equipment locations specified or detailed, other locations required for drainage of systems and elsewhere as indicated.

SPRING LOADED CHECK VALVES

Install a spring loaded check valve in each circulating pump discharge line, each clearwater sump pump discharge line and elsewhere as indicated.

SWING CHECK VALVES

Install swing check valves in recirculation branch lines and elsewhere as indicated. Provide weighted swing check valves at sanitary sump pump discharges.

PRESSURE REDUCING VALVES

Provide ball valve and strainer at inlet and ball valve at outlet. Install pressure gauges to indicate inlet and outlet pressure at each pressure reducing valve.

SAFETY RELIEF VALVES

Install relief valves on all pressure vessels and elsewhere as indicated. Inlet and outlet piping connecting to valves must be the same size as valve connections or larger. Pipe discharge to drain where indicated or to floor.

GAS PRESSURE REGULATORS

When the gas pressure regulator is equipped with a vent connection, run a connection size vent to outside air according to codes. Use a larger size vent when required by the manufacturer's installation instructions.

COMPRESSED AIR VALVES

Install shut-off valves at each piece of equipment, base of drip legs and elsewhere as indicated. Install safety exhaust shut-off valves at terminal equipment designed for frequent removal. Install pressure reducing valves at filter stations and elsewhere as indicated. Mount in readily accessible location for gauge and maintenance access.

SEWER AIR AND VACUUM VALVES

Install sewer air and vacuum valves at high points of forcemains, at grade changes, every 1/2 mile on lines with little gradient and elsewhere as indicated. Locate in valve manhole with watertight cover, sealed to top of main and of sufficient depth to prevent freezing. Mount valves allowing access in manhole for backflushing and servicing.

END OF SECTION 22 05 23

SECTION 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01

This section includes specifications for supports of all plumbing equipment and materials as well as piping system anchors.

RELATED WORK

Section 03100 & 03300 - Concrete formwork and cast-in-place concrete for equipment pads.

Section 22 07 00 - Plumbing Insulation for insulation protection at support devices.

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS

MSS SP-58

REFERENCE

Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

DESCRIPTION

Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

Do not hang any mechanical item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

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; see Related Work above.

SHOP DRAWINGS

Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service.

All submittals are to comply with submission and content requirements specified with in section [17 00 00].

DESIGN CRITERIA

Materials and application of pipe hangers and supports shall be according to MSS Standard Practice SP-58 unless noted otherwise.

Pipping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

PART 2 - PRODUCTS

MANUFACTURERS

Anvil, B-Line, Pate, Piping Technology, Roof Products & Systems or approved equal.

STRUCTURAL SUPPORTS

Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the drawings.

PIPE HANGERS AND SUPPORTS

HANGERS FOR PIPE SIZES 1/2" THROUGH 2":

Carbon steel, adjustable swivel ring. B-Line B3170NF, Anvil 69 or 70.

Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

HANGERS FOR PIPE SIZES 2" AND LARGER

Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

MULTIPLE OR TRAPEZE HANGERS

Steel channels with welded spacers and hanger rods.

WALL SUPPORT

Carbon steel welded bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type PS 200 H with PS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and

avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil PS 1400 series.

VERTICAL SUPPORT

Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

FLOOR SUPPORT

Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

COPPER PIPE SUPPORTS

All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide isolation collar between supports/clamps/fasteners and copper piping.

GLASS PIPE SUPPORTS

All supports, clamps, etc. directly connected to glass piping shall be fully lined with 1/4" neoprene padding.

PIPE HANGER RODS

STEEL HANGER RODS

Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

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.

<u>Maximum Load (Lbs.)</u> <u>(650°F Maximum Temp.)</u>	<u>Rod Diameter</u> <u>(inches)</u>
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

BEAM CLAMPS

MSS SP-58 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw. B-Line B3036L/B3034, Anvil 86/92.

MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter. B-Line B3054, Anvil 228.

CONCRETE INSERTS POURED IN PLACE

MSS SP-58 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by concrete in compression to maximize the load carrying capacity. B-Line B2505, Anvil 281.

MSS SP-58 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. B-Line B3014N, Anvil 282.

DRILLED FASTENERS

Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

CONTINUOUS CONCRETE INSERT CHANNELS

Steel inserts with an industry standard pre-galvanized finish, nominally 1-5/8 inch wide by 1-3/8 inch deep by length to suit the application, designed to be nailed to concrete forms and provide a linear slot for attaching other support devices. Installed channels to provide a load rating of 2000 pounds per foot in concrete. Manufacturer's standard brackets, inserts, and accessories designed to be used with the channel inserts may be used. Select insert length to accommodate all pipe in the area.

ANCHORS

Use welding steel shapes, plates, and bars to secure piping to the structure.

EQUIPMENT STANDS

Use structural steel members welded to and supported by pipe supports. Clean, prime and coat with three coat rust inhibiting alkyd paint or one coat epoxy mastic. Where exposed to weather, treat with corrosive atmosphere coatings.

ROOF MOUNTED PIPE ROLLER SUPPORT

Minimum height of support to be 14" above roof deck.

Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counterflashing with attached galvanized steel channel track for securing pipe roller and roller support. Do not use built-in metal base flashings or cants.

SUPPORTS 30" OR MORE IN HEIGHT

Use structural steel members supported by pipe supports and use pipe rollers fastened to the structural member. Pipe supports to be secured to the roof structure. Treat with corrosive atmosphere coatings.

CORROSIVE ATMOSPHERE COATINGS

Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanize threaded products, ASTM B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

1. Corrosive atmospheres include the following locations:
2. Exterior locations
3. Parking ramps
4. Swimming pool equipment rooms
5. Chemical storage and hazardous waste storage rooms
6. Wet wells
7. Sanitary pumping stations
8. Food service/kitchen areas
9. Walk-in coolers/freezers
10. Locker rooms
11. Greenhouses
12. Meter pits

PART 3 - EXECUTION

INSTALLATION

Size, apply and install supports and anchors in compliance with manufacturers recommendations.

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.

Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe insulation or directly on piping.

Perform welding according to standards of the American Welding Society.

HANGER AND SUPPORT SPACING

Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

Use hangers with 1-1/2 inch minimum vertical adjustment.

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 these specifications.

Space hangers for pipe as follows:

<u>Pipe Material</u>	<u>Pipe Size</u>	<u>Max. Horiz. Spacing</u>	<u>Max. Vert. Spacing</u>
Cast Iron	2" and larger	5'-0"	15'-0"
Copper	1/2" through 3/4"	5'-0"	10'-0"
Copper	1" through 1-1/4"	6'-0"	10'-0"
Copper	1-1/2" through 2-1/2"	8'-0"	10'-0"
Copper	3"	10'-0"	10'-0"
Ductile Iron	4" and larger	12'-0"	10'-0"
Glass	All	10'-0"	20'-0"
Steel	Per Pipe Mfr.	8'-0"	12'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-0"
Steel	8" through 12"	14'-0"	20'-0"
Plastic	14" and over	20'-0"	20'-0"
Plastic	Drain and Vent	4'-0"	10'-0"
Plastic	1" or less	32"	4'-0"
Plastic	1-1/4" and over	4'-0"	6'-0"
Plastic	Pure Water 1-1/2" or less	Continuous	5'-0"

RISER CLAMPS

Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

CONCRETE INSERTS AND CONTINUOUS INSERT CHANNELS

Select size based on the manufacturer's stated load capacity and weight of material that will be supported. Locate continuous insert channels on 6'-0" maximum centers and 2'-0" from corners. Furnish inserts to the General Contractor for placement in concrete formwork. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch size. Where concrete slabs form finished ceiling, provide inserts that are flush with the slab surface.

ANCHORS

Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

ROOF MOUNTED PIPE ROLLER SUPPORT

Secure bottom of support flat on roof deck. Apply two coats of zinc rich paint to cut edges of all galvanized steel elements. Flashing and counterflashing by the General Contractor.

END OF SECTION 22 05 29

SECTION 22 07 00 – PLUMBING INSULATION

PART 1 - GENERAL

SCOPE

This section includes insulation specifications for plumbing piping and equipment.

RELATED WORK

Section 22 05 00 - Common Work Results for Plumbing

Section 22 11 00 - Facility Water Distribution

Section 22 13 00 - Facility Sanitary Sewerage

Section 22 14 00 - Facility Storm Drainage

Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

Section 22 30 00 - Plumbing Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C177	Heat Flux and Thermal Transmission Properties
ASTM C195	Mineral Fiber Thermal Insulation Cement
ASTM C240	Cellular Glass Insulation Block
ASTM C302	Density of Preformed Pipe Insulation
ASTM C303	Density of Preformed Block Insulation
ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
ASTM C518	Heat Flux and Thermal Transmission Properties
ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
ASTM C547	Mineral Fiber Preformed Pipe Insulation
ASTM C552	Cellular Glass Block and Pipe Thermal Insulation
ASTM C553	Mineral Fiber Blanket and Felt Insulation
ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation
ASTM C591	Preformed Rigid Cellular Polyurethane Thermal Insulation
ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation
ASTM C612	Mineral Fiber Block and Board Thermal Insulation
ASTM C921	Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
ASTM E84	Surface Burning Characteristics of Building Materials
MICA	National Commercial & Industrial Insulation Standards
NFPA 225	Surface Burning Characteristics of Building Materials
UL 723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

DESCRIPTION

Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

1. Pipe Insulation
2. Equipment Insulation

Install all insulation according to the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the DFD Project Representative.

DEFINITIONS

Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

SHOP DRAWINGS

Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

PART 2 - PRODUCTS

MATERIALS

Materials or accessories containing asbestos will not be accepted.

Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions: Insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 150.

INSULATION AND JACKETS

Manufacturers: Armstrong, Certainteed Manson, Childers, Dow, Extol, Halstead, H.B. Fuller, Imcoa, Knauf, Owens-Corning, Pittsburgh Corning, Rubatex, Johns-Mansville, or approved equal.

Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

RIGID FIBERGLASS INSULATION

Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

SEMI-RIGID FIBERGLASS INSULATION

Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

CALCIUM SILICATE INSULATION

Rigid hydrous calcium silicate, ASTM C533, Type I, minimum dry density of 12.5 lbs. per cu. ft., thermal conductivity of not more than 0.44 at 300 degrees F, maximum water absorption of 90% by volume, minimum compressive strength 140 psi at 5% deformation, rated for service range of 0 degrees F to 1,200 degrees F. Material to be visually coded or marked to indicate it is asbestos free.

ELASTOMERIC INSULATION

Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor transmission of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

POLYOLEFIN INSULATION

Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor transmission of 0.0 perm inch, maximum water

absorption of 0% by weight and volume, rated for service range of -165 degrees F to 210 degrees F.

PHENOLIC INSULATION

Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.13 at 75 degrees F, minimum compressive strength of 31 psi parallel and 18 psi perpendicular, maximum water vapor transmission 0.117 perm inch, maximum water absorption of .5% by volume, rated for service range of -290 degrees F to 250 degrees F.

Kraft reinforced foil vapor barrier laminate all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

EXTRUDED POLYSTYRENE INSULATION

Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.2 at 75 degrees F, minimum compressive strength of 35 psi, maximum water vapor transmission of 1.1 perm inch, maximum water absorption of .1% by volume, rated for service range of -290 degrees F to 165 degrees F.

URETHANE INSULATION

Rigid closed cell polyisocyanurate, minimum nominal density of 1.8 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 19 psi parallel and 10 psi perpendicular, maximum water vapor transmission of 4 perm inch, maximum water absorption of .2% by volume, rated for service range of -290 degrees F to 300 degrees F.

CELLULAR GLASS INSULATION

Rigid closed cell, minimum nominal density of 8.5 lbs. per cu. ft., thermal conductivity of not more than 0.36 at 50 degrees F, minimum compressive strength of 100 psi, maximum water vapor transmission of 0.0 perm inch, maximum water absorption of .2% by volume, rated for service range of -450 degrees F to 900 degrees F.

FIREPROOFING INSULATION

Mineral fiber with nominal density of 8 lbs. per cu. ft., flame spread index of 15, fuel contribution index of 0, and smoke developed index of 0, thermal conductivity of not more than 0.23 at 75 degrees F.

Jacket material shall be the same as jacket for adjacent insulation.

PVC FITTING COVERS AND JACKETS

White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be .02 inch (20 mil).

METAL JACKETS

.016 inch thick aluminum or .010 inch thick stainless steel with safety edge.

INSULATION INSERTS AND PIPE SHIELDS

Manufacturers: B-Line, Pipe Shields, Value Engineered Products

Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x 6" block for piping through 2-1/2" and three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

Wood blocks will not be accepted.

ACCESSORIES

All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

Tack fasteners to be stainless steel ring grooved shank tacks.

Staples to be clinch style.

Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

Finishing cement to be ASTM C449.

Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

Bedding compounds to be non-shrinking and permanently flexible.

Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.

Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 - EXECUTION

INSTALLATION

Install insulation, jackets and accessories according to manufacturer's instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass insulation is allowed. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.

Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

Insulation shall be continuous through sleeves and openings. Vapor barriers shall be maintained continuous through all penetrations.

Provide a complete vapor barrier for insulation on the following systems:

1. Cold water (potable and non-potable)
2. Storm Water
3. Equipment piping with a surface temperature below 65 degrees F

PIPING, VALVE, AND FITTING INSULATION

GENERAL

Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive.

Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.

Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.

Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

INSULATION INSERTS AND PIPE SHIELDS

Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

FITTINGS AND VALVES

Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers. Secure PVC fitting covers with tack fasteners and 1-1/2" band of mastic over ends, throat, seams or penetrations. On systems requiring vapor barrier, use vapor barrier mastic.

ELASTOMERIC AND POLYOLEFIN

Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces.

PROTECTIVE JACKETS

Provide a protective PVC jacket for the following insulated piping:_____

Lap seams and joints a minimum of 2 inches and continuously seal with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used.

Provide a protective metal jacket for the following insulated piping:_____

Lap seams a minimum of 2 inches. Secure with metal bands for end to end joints, and rivets or sheet metal screws for longitudinal joints. Rivets, screws, and bands to be

constructed of the same material as the jacket. Locate seams on bottom for exterior applications.

Provide a protective covering of 2 coats of indoor/outdoor vapor barrier mastic with fabric reinforcing for the following insulated piping:_____

PIPE INSULATION SCHEDULE

Provide insulation on new and existing remodeled piping as indicated in the following schedule:

<u>Service</u>	<u>Insulation Types</u>	Insulation Thickness by Pipe Size				
		<u>1" and smaller</u>	<u>1-1/4" to 2"</u>	<u>2-1/2" to 4"</u>	<u>5" to 6"</u>	<u>8" and larger</u>
Hot Water Supply	Rigid Fiberglass	1"	1"	1.5"	1.5"	1.5"
Hot Water Circulating	Rigid Fiberglass	1"	1"	1.5"		
Cold Water	Rigid Fiberglass	0.5"	0.5"	1"	1"	1"
Tempered Water	Rigid Fiberglass	0.5"	0.5"	1"		
Non-Potable Cold Water	Rigid Fiberglass	*	0.5"	0.5"	1"	
Non-Potable Hot Water	Rigid Fiberglass	*	1"	1"	1.5"	
All Horizontal Storm Piping and 4'-0" of vertical Piping thereafter,						
& Roof Drain bodies	Rigid Fiberglass	0.5"	0.5"	0.5"	0.5"	0.5"
Clearwater Waste	Rigid Fiberglass	0.5"	0.5"	0.5"	0.5"	0.5"

* = Elastomeric & Phenolic types are acceptable

The following piping and fittings are not to be insulated:

1. Chrome plated exposed supplies and stops (except where specifically noted).
2. Water hammer arrestors.
3. Piping unions and flanges for systems not requiring a vapor barrier.

EQUIPMENT INSULATION

Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

SEMI-RIGID FIBERGLASS

Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place. Fill all joints, seams and depressions with insulating cement to a smooth, even surface. Cover with reinforcing fabric and 2 coats of mastic. . Use vapor barrier mastic on systems requiring a vapor barrier.

ELASTOMERIC/POLYOLEFIN

Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

EQUIPMENT INSULATION SCHEDULE

Provide equipment insulation as follows:

<u>Equipment</u>	<u>Insulation Type</u>	<u>Thickness</u>	<u>Remarks</u>
Storage Tanks	Semi-Rigid Fiberglass	2"	
Water Meter	Elastomeric	1/2"	Sheet type, fabricated for ease of removal and replacement when service is required.
Water Softener	Elastomeric	1/2"	Sheet type, fabricated for ease of removal and replacement when service is required.
Water Filters	Elastomeric	1/2"	Sheet type, pipe size type or combination of both. Fabricated for ease of removal and replacement when testing and servicing is required
R.P.B.P.	Elastomeric	1/2"	Sheet type, pipe size type or combination of both. Fabricated for ease of removal and replacement when testing and servicing is required

END OF SECTION 22 07 00

SECTION 22 11 00 – FACILITY WATER DISTRIBUTION

PART 1 – GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project.

RELATED WORK

22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI A21.4

ANSI A21.11

ANSI A21.51

ANSI B16.3 Malleable Iron Threaded Fittings

ANSI B16.4 Cast Iron Threaded Fittings

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A105 Forgings, Carbon Steel, for Piping Components

ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

ASTM B32 Solder Metal

ASTM B88 Seamless Copper Water Tube

ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe

ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D2464 Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

ASTM D2657 Heat Fusion Joining of Polyolefin Pipe and Fittings

ASTM D2774 Recommended Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3222	Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
ASTM D4101	Propylene Plastic Injection and Extrusion Materials
ASTM F437	Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F441	Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80
ASTM F493	Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings
ASTM F656	Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
AWS A5.8	Brazing Filler Metal
AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water
AWWA C110	Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C111	Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
AWWA C151	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
AWWA C153	Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances
AWWA C651	Disinfecting Water Mains
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

SHOP DRAWINGS

Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, AWWA or CISPI specification contained in this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, AWWA or CISPI specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS

Welding procedures, welders, and welding operators for all building service piping to be according to certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of

Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures according to the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the State's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 - PRODUCTS

DOMESTIC WATER

ABOVE GROUND

Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.

Ductile iron pipe, thickness Class 53, AWWA C151/C115; with standard thickness cement mortar lining, AWWA C104; ductile iron mechanical grooved cement mortar lined fittings and couplings on cut grooved pipe, Class 350 12" and below, Class 250 above 12", AWWA C606; ductile iron or gray iron flanged cement mortar lined fittings, Class 250, AWWA C110; rubber gasket joints with non-toxic gasket lubricant, AWWA C111.

Galvanized steel, Schedule 40, Grade A, ASTM A53; with cast iron threaded fittings, Class 125, ANSI B16.4; forged steel threaded fittings, ANSI 16.11; mechanical cut groove couplings and fittings; galvanize coat all fittings, ASTM A123.

BELOW GROUND 2-1/2" AND SMALLER:

Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.

BELOW GROUND 3" AND LARGER

Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron

mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.

PVC pressure pipe, DR 18, Class 150, AWWA C900 and C905; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.

UNDERGROUND TO INTERIOR BUILDING ENTRANCE PIPING 3" AND LARGER

Ductile iron as specified above with factory threaded and machined flanges.

HYDRANT LEADS

Ductile iron pipe, restrained mechanical joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron restrained mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron restrained mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.

THRUST RESTRAINTS FOR UNDERGROUND PIPING

Asphaltic or epoxy coated ductile iron follower gland mechanical joint restraint with gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference, low alloy steel T-bolts and UL listing or Factory Mutual approval. For PVC pipe joint bells, use epoxy or primer coated ductile iron bell and serrated ring restraints or gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference with low alloy steel tie bolts. Restraint to have minimum pressure rating and safety factor equal to or greater than pressure rating and safety factor of pipe and be designed specifically for the pipe material it's applied on.

DIELECTRIC UNIONS AND FLANGES

Watts Regulator Company, Lochinvar, Wilkins or EPCO Sales, Inc., dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees.

UNIONS AND FLANGES

Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be teflon type. Treated paper gaskets are not acceptable.

2" AND SMALLER STEEL

ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

2" AND SMALLER COPPER

ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

2-1/2" AND LARGER STEEL

ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face teflon gaskets for mating with other flat face flanges on equipment. Gaskets shall be teflon type.

2-1/2" AND LARGER COPPER

ANSI B15.24 Class 150 cast bronze flanges with full face teflon gaskets.

MECHANICAL GROOVED PIPE CONNECTIONS

Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Gruvlok Grinnell or Shurjoint may be used with cut groove galvanized steel pipe, cut groove ductile iron pipe or roll groove copper pipe where noted. Mechanical grooved components and assemblies to be rated for minimum 250 psi working pressure.

All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer.

Couplings to be malleable iron, ASTM A47, or ductile iron ASTM A536 with painted finish. Reducing couplings are not acceptable.

Fittings used on galvanized steel pipe to be malleable iron, ASTM A47, or ductile iron A536, with galvanized finish, ASTM A153. Fittings used on ductile iron pipe to be cement mortar lined ductile iron with coal tar coating, ASTM A536; conforming to requirements of AWWA C110/C153 and AWWA C606. Fittings used on copper pipe to be copper.

Gaskets to be EPDM, ASTM D2000. Gaskets for hot water systems and dry pipe systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A183, with zinc electroplated finish ASTM B633.

Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

Credit for the inherent flexibility of mechanical grooved pipe connections when used for expansion joints or flexible connectors may be allowed upon specific application by the Contractor. Three flexible couplings at first three connection points both upstream and downstream of pumps may be used in lieu of flexible connectors. Request for expansion joints shall be made in writing and shall include service, location, line size, proposed application and supporting calculations for the intended service.

PART 3 - EXECUTION

GENERAL

Install pipe and fittings according to reference standards, manufacturers recommendations and recognized industry practices.

PREPARATION

Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

ERECTION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

Maintain piping in clean condition internally during construction.

Provide clearance for installation of insulation, access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

WELDED PIPE JOINTS

Make all welded joints by fusion welding according to ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

THREADED PIPE JOINTS

Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

SOLVENT WELDED PIPE JOINTS

Install according to ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturers recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the DFD Project Representative.

MECHANICAL HUBLESS PIPE CONNECTIONS

Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

MECHANICAL JOINT PIPE CONNECTIONS

Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert

bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

PUSH-ON GASKETED PIPE CONNECTIONS

Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Ensure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

MECHANICAL GROOVED PIPE CONNECTIONS

Use pipe factory grooved according to the coupling manufacturer's specifications or field grooved pipe according to the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint according to the coupling manufacturer's specifications.

MECHANICALLY FORMED TEE FITTINGS

Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

DOMESTIC WATER

Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.

Install exterior water piping below predicted frost level according to COMM Table 82.30-6, but in no case less than 6' bury depth to top of pipe. Maintain minimum of 8' horizontal distance between 2-1/2" and larger water piping and sanitary sewer piping. Maintain minimum of 30" horizontal and 12" vertical distance, water on top, between 2" and smaller water piping and sanitary sewer piping. Where water piping crosses a sanitary sewer, provide minimum 18" vertical clearance and waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions.

Provide thrust restraints for 3" and larger exterior water piping joints, hydrants, caps, plugs, fittings and bends of 22-1/2 degrees or more. Field apply continuous anti-corrosion coating to rodded restraint components. Protect mechanical joints, nuts and bolts from concrete cover. Cover with 8 mil sheet or tube polyethylene material sleeve.

Install interior water piping with drain valves where indicated and at low points of system to allow complete drainage. Install shutoff valves where indicated and at the base of risers

to allow isolation of portions of system for repair. Do not install water piping within exterior walls.

Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears clear. Fill system with a solution of water and chlorine containing at least 50 parts per million of chlorine and allow to stand for 24 hours. Alternately a solution containing at least 200 parts per million of chlorine may be used and allowed to stand for 3 hours. Flush system with potable water until chlorine concentration is no higher than source water level.

Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of samples shall be representative of the system size and configuration and are subject to approval by engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.

UNDERGROUND PIPE WRAP

Use for steel piping encased in concrete or underground which is not in a conduit. Remove all dirt and other foreign material from exterior of pipe. Apply primer as recommended by the manufacturer. Use a spiral wrap process for applying tape to the pipe. Repair any breaks in the tape coating caused by the installation process.

DIELECTRIC UNIONS AND FLANGES

Install dielectric unions or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

UNIONS AND FLANGES

Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

PIPING SYSTEM LEAK TESTS

Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

Entire test must be witnessed by the Division's representative. All pressure tests are to be documented on Division of Facilities Development forms to be provided to the contractor.

<u>System</u>	<u>Test</u>	<u>Initial Test</u>		<u>Final Test</u>	
	<u>Medium</u>	<u>Pressure</u>	<u>Duration</u>	<u>Pressure</u>	<u>Duration</u>
*Below Ground Domestic Water	Water	Water	N/A	200 psig	2 hr
Above Ground Domestic Water	Water	Water	N/A	100 psig	8 hr
Above Ground Non-potable Water	Water	Water	N/A	100 psig	8 hr
Below Ground Non-potable Water	Water	Water	N/A	100 psig	8 hr

* Leakage on exterior mains 3" and larger may not exceed leakage calculated as follows:

$$\text{GPH Allowable Leakage} = \frac{(\text{Feet of Pipe}) (\text{Inches Dia. of Pipe}) (\text{Test Pressure})^5}{133,200}$$

END OF SECTION 22 11 00

PIPING SYSTEM TEST REPORT

State of Wisconsin

Department of Administration

Division of Facilities Development_____

Date Submitted:_____

Project Name:_____

Location:_____ DFD Project No:_____

Contractor:_____

☐ Plumbing ☐ Fire Sprinkler

Test Medium: ☐ Air ☐ Water ☐ Other_____

Test performed per specification section No._____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification:_____

Describe Location:_____

Test Date:

Stop Test Time:_____ Initial Pressure:_____ PSIG

Stop Test Time:_____ Final Pressure:_____ PSIG

Tested By:_____

Witnessed By:_____

Title:_____

Title:_____

Signed:_____

Signed:_____

Date:_____

Date:_____

Comments:_____

SECTION 22 13 00 – FACILITY SANITARY SEWERAGE

PART 1 – GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project

RELATED WORK

22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI A21.4

ANSI A21.11

ANSI A21.51

ANSI B16.3 Malleable Iron Threaded Fittings

ANSI B16.4 Cast Iron Threaded Fittings

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A74 Cast Iron Soil Pipe and Fittings

ASTM A105 Forgings, Carbon Steel, for Piping Components

ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

ASTM A861 High Silicon Iron Pipe and Fittings

ASTM A888 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

ASTM B32 Solder Metal

ASTM B306 Copper Drainage Tube (DWV)

ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

ASTM C76 Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe

ASTM C564 Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

ASTM C1540 Standard Specifications for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings

ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe

ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
ASTM D2665	Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
ASTM D2729	Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D2774	Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
ASTM D3034	Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3222	Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
ASTM D3311	Drain, Waste and Vent (DWV) Plastic Fitting Patterns
AWS A5.8	Brazing Filler Metal
CISPI 301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
CISPI 310	Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications

SHOP DRAWINGS

Schedule from the contractor indicating the ASTM, or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, or CISPI specification contained in this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, or CISPI specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS

Welding procedures, welders, and welding operators for all building service piping to be according to certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures according to the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the State's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 - PRODUCTS

SANITARY WASTE AND VENT INTERIOR ABOVE GROUND

Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 301, CISPI 310, ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute or receive prior approval of the engineer. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.

PRESSURIZED INTERIOR ABOVE GROUND

Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813.

Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.

INTERIOR BELOW GROUND

Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74, with neoprene rubber compression gaskets, ASTM C564, CISPI 301, and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

EXTERIOR BELOW GROUND 10" AND SMALLER

Non-reinforced concrete sewer, storm drain and culvert pipe, Class III, ASTM C14; rubber gasket joints, ASTM C443; bell and spigot ends with opposing shoulder or confined O-ring seal configuration, ASTM C302.

EXTERIOR BELOW GROUND 15" AND SMALLER

Cast iron soil pipe and fittings, CISPI 301, ASTM A74 or ASTM A888 with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

Type PSM PVC sewer pipe and socket fittings, SDR 35, Class 12454-B (PVC 1120), ASTM D3034; primer, ASTM F656; solvent cement, ASTM 2564; or integral bell and flexible elastomeric seal, ASTM D3212.

Corrugated PVC pipe and fittings with smooth interior, ASTM F949; gasketed joint, ASTM D3212; elastomeric gasket, ASTM F477.

PRESSURIZED BELOW GROUND 3" AND SMALLER

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

Type K copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813.

PRESSURIZED BELOW GROUND 3" AND LARGER

PVC pressure pipe, DR 18, Class 150, AWWA C900; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.

ACID WASTE AND VENT

Polypropylene pipe and fittings, Schedule 40, ASTM F1412; Type 110 or 210, ASTM D4101; flame retardant (<5 sec & 5 mm) ASTM D635; electrofusion socket fittings; fitting patterns, ASTM D3311.

(Note: Mechanical joints are not allowed in acid waste piping, except at sink and fixture outlets at the trap connections; to facilitate maintenance and replacement of traps.)

Borosilicate glass pipe and fittings for drain, waste and vent; ASTM C1053; with beaded ends; 304 stainless steel mechanical couplings; Buna-N rubber compression liners; TFE seal ring gaskets; padded pipe hangers and padded pipe riser clamps. Factory fabricate underground piping with expanded polystyrene covering. Field wrap and secure underground fittings with 5 mil polyvinyl film. Include minimum of 3 site installation training and inspection sessions from factory representative.

PART 3 - EXECUTION

GENERAL

Install pipe and fittings according to reference standards, manufacturers recommendations and recognized industry practices.

PREPARATION

Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

ERECTION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

Maintain piping in clean condition internally during construction.

Provide clearance for installation of insulation, access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make

connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

WELDED PIPE JOINTS

Make all welded joints by fusion welding according to ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

THREADED PIPE JOINTS

Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

SOLVENT WELDED PIPE JOINTS

Install according to ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturer recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the DFD Project Representative.

MECHANICAL HUBLESS PIPE CONNECTIONS

Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

MECHANICAL JOINT PIPE CONNECTIONS

Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

PUSH-ON GASKETED PIPE CONNECTIONS

Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Ensure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

MECHANICAL GROOVED PIPE CONNECTIONS

Use pipe factory grooved according to the coupling manufacturer's specifications or field grooved pipe according to the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint according to the coupling manufacturer's specifications.

SANITARY WASTE AND VENT

Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/4" per foot where possible and in no case less than 1/8" per foot for piping 3" and larger.

Install exterior piping below predicted frost level and not less than 5' bury depth to top of pipe wherever possible. Where piping is located above predicted frost level, provide frost protection according to SPS 382.30(11)(c).

Flush piping inlets (floor drains, hub drains, mop basins, fixtures, etc.) with high flow of water at completion of project to demonstrate full flow capacity. Remove blockages and make necessary repairs where flow is found to be impeded.

PIPING SYSTEM LEAK TESTS

Isolate or remove components from system which are not rated for test pressure. Perform final testing for medical and lab gas with all system components in place. Test piping in

sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

Entire test must be witnessed by the Division's representative. All pressure tests are to be documented on *Division of Facilities Development* forms to be provided to the contractor.

<u>System</u>	<u>Test</u>	<u>Initial Test</u>		<u>Final Test</u>	
	<u>Medium</u>	<u>Pressure</u>	<u>Duration</u>	<u>Pressure</u>	<u>Duration</u>
Sanitary Waste and Vent	Water	Water	N/A	10' water	2 hr
Pressurized Sanitary Waste & Vent	Water	Water	N/A	100 psig	2 hr
Acid Waste and Vent	Water	Water	N/A	10' water	2 hr

END OF SECTION 22 13 00

SECTION 22 13 60 – SANITARY AND STORM WATER SUMPS, PUMPS, AND ACCESSORIES

PART 1 – GENERAL

SCOPE

RELATED WORK

Section 22 13 00 - Facility Sanitary Sewerage

Section 22 14 00 - Facility Storm Drainage

Section 22 05 23 - General-Duty Valves for Plumbing Piping

REFERENCE

Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Include data concerning dimensions, capacities, materials of construction, ratings, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

Pump curves shall identify design point of operation.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

Pump sizes, capacities, pressures and operating characteristics shall be as scheduled.

Pumps shall meet or exceed operating efficiencies scheduled.

Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard, and other accessories specified. Statically and dynamically balance all rotating parts.

Provide pump with a motor sized for non-overloading over the entire pump curve. Motors to be 1750 rpm unless specified otherwise.

Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

Test all pumps, clean and paint before shipment. The manufacturer shall certify all pump ratings.

All pumps to operate without excessive noise or vibration.

After completion of balancing, provide replacement of impellers, or trim impellers to provide specified flow at actual pumping head, as installed.

PART 2 – PRODUCTS

SANITARY EFFLUENT SUMP PUMPS AND SUMPS

MANUFACTURERS:

Goulds, Liberty, Little Giant or Zoeller

PUMPS:

Pump shall be a fully-assembled sump pump suitable for effluent duty only, with integral base mounting and support feet to keep pump above the base of the sump.

Refer to the Schedule on the Drawings for pump capacity requirements.

Pump shall include an integral lifting handle.

Pump shall be hermetically sealed allowing for infrequent submersion in liquid.

SUMPS:

Sumps shall be polyethylene molded one-piece construction with separate top.

Refer to the Schedule on the Drawings for sump dimensions and capacities

Provide sumps with gasketed polyethylene covers and stainless steel fasteners. Covers shall be suitable for pedestrian traffic only.

Underground discharge and vent connections are recommended for this project. Provide field-installable rubber hubs for connecting the discharge and vent piping to the side of the sump.

ACCESSORIES:

Equip the pump discharge with a non-metallic check valve and a non-metallic isolation valve. Valve shall be located within the sump vessel.

PART 3 – EXECUTION

INSTALLATION

Plumbing Contractor shall excavate for sump. Excavate to depth needed and do not over-excavate. Set sump on a minimum of 3 inches of gravel or crushed rock base. Level and compact base prior to setting sump. Manual compaction will be acceptable.

Ensure connecting piping is adequately supported. Backfill carefully and compact in 3 inch lifts. Backfill with water is encouraged around piping.

Sanitary sumps shall be set so the rim of the sump is flush with finished floor elevation. Provide temporary covers for concrete pouring, or supply new covers after completion of all concrete work. Do not install the pump or valves within the sump until all concrete work is complete.

Make all piping connections as shown or indicated.

The sump pump is supplied with an integral float, cord and plug assembly. The Plumbing Contractor is responsible for all electrical wiring with the exception of a receptacle. Ensure the sump is correctly connected and set and is not obstructed by any field piping. No separate alarm will be required for this sump pump.

END OF SECTION 22 13 60

SECTION 22 14 00 – FACILITY STORM DRAINAGE

PART 1 – GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project.

RELATED WORK

22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI A21.4

ANSI A21.11

ANSI A21.51

ANSI B16.3 Malleable Iron Threaded Fittings

ANSI B16.4 Cast Iron Threaded Fittings

ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A861	High Silicon Iron Pipe and Fittings
ASTM A888	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B32	Solder Metal
ASTM B88	Seamless Copper Water Tube
ASTM B306	Copper Drainage Tube (DWV)
ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM C76	Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe
ASTM C443	Joints for Circular Concrete Pipe Sewer and Culvert Pipe Using Rubber Gaskets
ASTM C564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C1540	Heavy Duty Shielded Couplings for Joining Hubless Cast Iron Soil Pipe and Fittings
ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
ASTM D2321	Underground Installation of Flexible Thermoplastic Sewer Pipe
ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2513	Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
ASTM D2657	Heat Fusion Joining of Polyolefin Pipe and Fittings
ASTM D2665	Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
ASTM D2729	Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D2774	Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
ASTM D3034	Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3311	Drain, Waste and Vent (DWV) Plastic Fitting Patterns

ASTM D4101	Propylene Plastic Injection and Extrusion Materials
ASTM F405	Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F437	Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F441	Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80
ASTM F656	Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
CISPI 301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
CISPI 310	Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications

SHOP DRAWINGS

Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, AWWA or CISPI specification contained in this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, AWWA or CISPI specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS

Welding procedures, welders, and welding operators for all building service piping to be according to certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures according to the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the State's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 - PRODUCTS

STORM AND CLEARWATER WASTE and VENT INTERIOR ABOVE GROUND

Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 301, CISPI 310, ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.

Copper drainage tube (DWV), ASTM B306; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

PRESSURIZED INTERIOR ABOVE GROUND

Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813.

Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.

INTERIOR BELOW GROUND 15" AND SMALLER

Cast iron soil pipe and fittings, hub and spigot, service weight, CISPI 301, ASTM A74; ASTM A888 with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

EXTERIOR BELOW GROUND 10" AND SMALLER

Non-reinforced concrete sewer, storm drain and culvert pipe, Class III, ASTM C14; rubber gasket joints, ASTM C443; bell and spigot or tongue and groove ends.

EXTERIOR BELOW GROUND 15" AND SMALLER

Cast iron soil pipe and fittings, hub and spigot, service weight, CISPI 301, ASTM A74; ASTM A888 with neoprene compression rubber gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM 2564.

Type PSM PVC sewer pipe and fittings, SDR 35, Class 12454-B (PVC 1120), ASTM D3034; primer, ASTM F656; solvent cement, ASTM 2564; or integral bell and flexible elastomeric seal, ASTM D3212.

Corrugated PVC pipe and fittings with smooth interior, ASTM F949; gasketed joint, ASTM D3212; elastomeric gasket, ASTM F477.

Corrugated polyethylene pipe with smooth interior and minimum pipe stiffness of 50 psi, ASTM F-405/ASTM F-667, AASHTO M-252/AASHTO M-294 Type S; PVC gasketed fittings, ASTM F1336; elastomeric gasket, ASTM F477.

EXTERIOR BELOW GROUND 12" AND LARGER

Reinforced concrete culvert, storm drain and sewer pipe, Class III, ASTM C76; rubber gasket joints, ASTM C443; bell and spigot or tongue and groove ends.

PRESSURIZED BELOW GROUND 3" AND SMALLER

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564

Type K copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813.

PRESSURIZED BELOW GROUND 3" AND LARGER

Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.

PVC pressure pipe, DR 18, Class 150, AWWA C900; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.

SUBSOIL DRAIN

Corrugated polyethylene tubing and fittings, standard tubing, perforated, ASTM F405; with polypropylene fabric filter cover.

PVC sewer pipe and fittings, perforated, Class 12454-B (PVC 1120), ASTM D2729; primer, ASTM F656; solvent cement, ASTM 2564; with polypropylene fabric filter cover.

PART 3 - EXECUTION**GENERAL**

Install pipe and fittings according to reference standards, manufacturers recommendations and recognized industry practices.

PREPARATION

Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

ERECTION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

Maintain piping in clean condition internally during construction.

Provide clearance for installation of insulation, access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

WELDED PIPE JOINTS

Make all welded joints by fusion welding according to ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

THREADED PIPE JOINTS

Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

SOLVENT WELDED PIPE JOINTS

Install according to ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturers recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the DFD Project Representative.

MECHANICAL HUBLESS PIPE CONNECTIONS

Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

MECHANICAL JOINT PIPE CONNECTIONS

Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

PUSH-ON GASKETED PIPE CONNECTIONS

Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Ensure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

MECHANICAL GROOVED PIPE CONNECTIONS

Use pipe factory grooved according to the coupling manufacturer's specifications or field grooved pipe according to the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint according to the coupling manufacturer's specifications.

STORM AND CLEARWATER WASTE and VENT

Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/8" per foot where possible and in no case less than 1/16" per foot for piping 3" and larger.

Install exterior piping below predicted frost level and not less than 5' bury depth to top of pipe wherever possible. Where piping is located above predicted frost level, provide frost protection according to SPS 382.30(11)(c).

SUBSOIL DRAIN

Verify invert elevations and building elevations prior to installation. Install piping sloped to drain to locations indicated. Where subsoil drains are required to penetrate foundation work, sleeve subsoil drains or use nonperforated sections of piping and place prior to foundation work.

Secure joints and piping where corrugated polyethylene is used to prevent movement during laying and backfill. Route piping in straight lines. Plug dead ends of pipe with pipe

caps or concrete plugs. Extend filter fabric cover over all piping and fittings with fabric cover joints overlapping and banded.

Bed piping on and backfill around subsoil drains with pea gravel or No. 2 coarse aggregate (DOT 501.3.6.4.5) to a level 12" above or as indicated.

PIPING SYSTEM LEAK TESTS

Isolate or remove components from system which are not rated for test pressure. Perform final testing for medical and lab gas with all system components in place. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

Entire test must be witnessed by the Division's representative. All pressure tests are to be documented on Division of Facilities Development forms to be provided to the contractor.

<u>System</u>	<u>Test</u>	<u>Initial Test</u>		<u>Final Test</u>	
	<u>Medium</u>	<u>Pressure</u>	<u>Duration</u>	<u>Pressure</u>	<u>Duration</u>
Clearwater Waste and Vent	Water	Water	N/A	10' water	2 hr
Storm and Clearwater Waste	Water	Water	N/A	10' water	2 hr
Pressurized Storm/Clearwater Waste	Water	Water	N/A	100 psig	2 hr

END OF SECTION 22 14 00

SECTION 22 30 00 – PLUMBING EQUIPMENT

PART 1 – GENERAL

SCOPE

This section includes specifications for water heaters, water softeners, pumps and other equipment used for plumbing applications.

RELATED DOCUMENTS

Section 22 05 23 - General-Duty Valves for Plumbing Piping

Section 22 05 15 - Piping Specialties

Section 22 05 13 - Common Motor Requirements for Plumbing Equipment.

Section 22 07 00 - Plumbing Insulation

Division 26 00 00 - Electrical

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Article 7.

Plumbing products requiring approval by the State of Wisconsin Dept. of Safety and Professional Services must be approved or have pending approval at the time of shop drawing submission.

SHOP DRAWINGS

Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

PART 2 - PRODUCTS

RESIDENTIAL GAS FIRED WATER HEATER

Manufacturers: American, A.O. Smith, Bock, Bradford White, Lochinvar, Rheem, Ruud, State.

COMMERCIAL ATMOSPHERIC GAS FIRED WATER HEATER

Manufacturers: American, A.O. Smith, Bock, Bradford White, Lochinvar, Rheem, Ruud, State.

Type: Commercial natural gas fired atmospheric storage water heater. Design to be AGA certified for 180° water with 3 year tank and parts warranty.

Efficiency: >50 gallons or >75,000 Btu/h 80% Minimum Thermal Efficiency
($Q/800+110\sqrt{V}$) Maximum Standby Loss
Q=Input Btu/h, V=Volume Gallons

Tank: Steel glass lined tank rated for 150 psig complete with 2 removable magnesium anode rods or single impressed current anode rod, 4" tank access hand hole, foam or fiberglass insulation, painted steel jacket, vertical draft hood, drain valve and temperature and pressure relief valve.

Burner: Construct burner of cast iron, aluminized steel (natural gas only) or stainless steel.

Controls: 120 volt, 1 phase, 60 Hz controls consisting of junction box, 24 volt transformer, intermittent spark ignition, electric flue damper, operating thermostat with adjustable temperature control, energy cutoff with manual reset, gas valve and pressure regulator.

COMMERCIAL POWERED GAS FIRED WATER HEATER

Manufacturers: A.O. Smith, Bock, Bradford White, PVI, Lochinvar, Rheem, Ruud, State.

Type: Commercial natural gas fired power burner storage water heater. Design to be National Board stamped and UL listed with 3 year tank and parts warranty. Water heater to include start-up and training by manufacturer's representative.

Efficiency: >50 gallons or >75,000 Btu/h 80% Minimum Thermal Efficiency
($Q/800+110\sqrt{V}$) Maximum Standby Loss
Q=Input Btu/h, V=Volume Gallons

Tank: Steel glass or nickel lined water leg type tank, ASME construction and stamp, rated for 160 psig complete with 6 removable magnesium anode rods, 2-4" tank access hand holes, foam or fiberglass insulation, painted steel jacket, drain valve and temperature and pressure relief valve per CSA rating.

Burner: Flame retention gas burner with pilot and main gas valves and regulators; 3500 RPM capacitor start fan; solenoid gas valve; air switch; pilot light; on-off switch; flame inspection port; intermittent ignition; flame safety control with pre-purge, flame rod and ultra-violet detector.

Controls: 120 volt, 1 phase, 60 Hz controls consisting of junction box, 24 volt transformer, dual bulb operating thermostat with adjustable temperature control and high limit control with manual reset.

HIGH EFFICIENCY COMMERCIAL GAS FIRED WATER HEATER

Manufacturers: A.O. Smith, Bradford White, Bock, Lochinvar, State.

Type: Gas fired sealed combustion condensing commercial storage water heater, minimum 92% thermal efficiency. Design to be AGA certified with 3 year tank warranty and 1 year parts warranty.

Tank: Steel glass lined tank rated for 150 psig complete with multiple removable magnesium anode rods or single impressed current anode rod, submerged combustion chamber, 4" tank access hand hole, foam insulation, painted steel jacket, brass drain valve and temperature and pressure relief valve.

Burner: Top mounted down fired premix low NOx power burner.

Controls: 120 volt, 1 phase, 60 Hz electronic controls, intermittent spark or hot surface ignition, operating thermostat with 110°-180°F adjustable temperature control, energy cutoff with manual reset, blower pressure switch, gas valve and pressure regulator.

Vent: 3" or 4" PVC, CPVC or ABS combustion air intake and flue gas outlet with DWV solvent weld fittings.

HIGH EFFICIENCY STAINLESS STEEL COMMERCIAL GAS FIRED WATER HEATER

Manufacturers: Heat Transfer Products, National Combustion, Rheem.

Type: Gas fired sealed combustion condensing commercial water heater, minimum 94% thermal efficiency. Design to be AGA certified with 3 year tank warranty and 1 year parts warranty.

Tank: 316L stainless steel tank rated for 150 psig complete with submerged combustion chamber, 90/10 cupronickel heat exchanger, foam insulation, plastic jacket, brass drain valve and temperature and pressure relief valve.

Burner: Side mounted power burner.

Controls: 120 volt, 1 phase, 60 Hz self-diagnostic electronic controls, intermittent spark or hot surface ignition, operating thermostat with 70°-180°F adjustable temperature control, energy cutoff with manual reset, blower pressure switch, gas valve and pressure regulator.

Vent: 3" CPVC or ABS flue gas outlet and PVC, CPVC or ABS combustion air intake with DWV solvent weld fittings.

HIGH EFFICIENCY COPPER-NICKEL TUBE GAS FIRED WATER HEATER

Manufacturers: Aerco, Laars.

Type: Gas fired sealed combustion condensing commercial water heater, minimum 90% thermal efficiency. Design to be AGA certified with 5 year heat exchanger warranty and 1 year parts warranty.

Heat Exchanger: 90/10 copper-nickel water or fire tubes, glass lined cast iron headers or exhaust manifold, where unit incorporates a secondary heat exchanger it shall be stainless steel, rated for 150 psi operating pressure complete with temperature and pressure relief valve.

Burner: Premix power burner with air/fuel valve, modulation down to 25% with main gas pressure regulator.

Controls: 120 volt, 1 phase, 60 Hz controls consisting of junction box, 24 volt transformer, intermittent spark or hot surface ignition with low gas pressure switch, high and low air pressure switches, water flow switch, low water cutoff. Operating and diagnostic panel to include water temperature gauges, adjustable high limit, adjustable thermostat with adjustable differential, operating and warning lights.

Vent: AL29-4C or 316L stainless steel vent piping with inlet, outlet and wall penetration fittings. 24 gauge galvanized steel combustion air piping.

COPPER FIN GAS FIRED WATER HEATER

Manufacturers: A.O. Smith, Laars, Lochinvar, Raypak.

Type: Commercial natural gas fired copper fin domestic water heater, minimum 82% thermal efficiency. Design to be AGA certified and bear ASME Section IV seal for 160 psig. Provide 5 year warranty on heat exchanger tubes and parts and 1 year warranty on controls and combustion chamber

Heat Exchanger: Copper tubes with integral fins rolled into bronze (*porcelain coated cast iron*) header. Construct header with removable cover and temperature and pressure relief valve per CSA rating. Heat exchanger assembly to be removable without disassembly of burners.

Burner and Combustion Chamber: Construct burner of stainless steel and combustion chamber of cast refractory cement, minimum 2" thickness.

Shell: Construct frame of galvanized steel with built in draft diverter and flue gas collector. Construct jacket of galvanized steel with baked acrylic enamel finish and insulate with fiberglass.

Controls: 120 volt, 1 phase, 60 Hz controls consisting of junction box, 24 volt transformer, operating thermostat with adjustable temperature control, high limit control with manual

reset, redundant mechanical modulating (*single stage, 2 stage, motorized modulating*) gas valve, gas regulator, manual gas shutoff valve and electronic spark ignition with flame safeguard.

RESIDENTIAL ELECTRIC WATER HEATER

Manufacturers: A.O. Smith, American, Bradford White, Lochinvar, Rheem, Ruud, State.

Type: Electric storage domestic water heater. Design to be UL listed with 3 year commercial use tank warranty and 1 year parts warranty.

Efficiency:	20 gallons and ≤ 12 kW	0.94 Minimum Energy Factor
	>30 gallons and ≤ 12 kW	0.93 Minimum Energy Factor

Tank: Steel glass lined tank rated for 150 psig complete with removable magnesium anode rod, plastic diffuser type dip tube, inlet and outlet heat trap fittings, minimum R-20 polyurethane foam insulation, painted steel jacket, drain valve and temperature and pressure relief valve.

Elements: Dual 4500 watt heating elements to be replaceable threaded low watt density incoloy sheath with adjustable thermostat control, energy cutoff and wired for non-simultaneous operation.

SEMI-INSTANTANEOUS STEAM WATER HEATER

Manufacturer: Ace Buehler Mini-Pack, Aerco B-Plus, Cemline, Patterson-Kelley P-K Compact, PVI Quick Draw, Thermodyne HX.

Type: Factory fabricated and packaged vertical semi-instantaneous steam to water heater.

Construct and stamp according to Section VIII of the ASME Code for a working pressure of 150 psig.

Design with flanges and unions at steam, condensate and water connections for removal of heat exchanger.

All materials (including fittings and piping) in contact with domestic water are to be non-ferrous, provide double wall copper/nickel (inner and outer) tube steam (steam in tubes) bundle(s) with nonferrous tube sheet and baffles. Stainless steel, copper/nickel, copper silicon, nickel lined or copper lined carbon steel hot water shell. Cast iron or steel steam chamber.

Integral water storage capacity shall be 45 gallons minimum. If this capacity cannot be met a separate 100 gallon minimum storage tank installation shall be provided with the water heater installation.

Controls: 2-way normally closed pneumatic spring return modulating control valve with stainless steel trim, TFE seat and packing, sensing bulb, adjustable controller and load

anticipator capable of maintaining outlet temperature within +/-4°F of setpoint over flow range of 3-100% of rated flow. Double solenoid electric hi-limit with automatic reset capable of shutting steam valve on overtemperature. All wiring to be factory packaged, enclosed in control enclosure or conduit.

Accessories: ASME temperature and pressure relief valves sized per CSA rating, steam and condensate strainers, main and auxiliary steam traps, water thermometer, steam pressure gauge, 1-1/2" fiberglass insulation with painted steel jacketing, painted structural steel support frame, lifting lugs, bronze 1/12 HP circulator pump with isolation ball valves and disconnect switch, Type K ASTM B88 copper water piping, Schedule 40 ASTM A53 black steel steam piping, Schedule 80 ASTM black steel condensate piping.

Warranty: Non-prorated 10 year warranty for heat exchanger, shell and load anticipator controls against any failure. Provide factory warranty with shop drawing submittals and operation and maintenance manuals.

STORAGE STEAM WATER HEATER

Manufacturer: Adamson, Cemline, Patterson-Kelley, Reco.

Type: Factory fabricated and packaged vertical (*horizontal*) tank horizontal tube steam to water heater.

Construct and stamp according to Section VIII of the ASME Code for a working pressure of 150 psig.

Design with flanges and unions at steam and condensate connections and water connections at tank to allow easy removal of heat exchanger without disturbing water piping.

All materials (including fittings and piping) in contact with domestic water are to be non-ferrous, provide double wall copper/nickel (inner and outer) tube steam (steam in tubes) bundle(s) with nonferrous tube sheet and baffles. Stainless steel, copper/nickel, copper silicon, nickel lined or copper lined carbon steel hot water shell. Cast iron or steel steam chamber. Wire brush tank exterior and apply one coat epoxy mastic for 5-8 mil minimum dry film thickness or abrasive blast and apply 3 coat alkyd finish.

Controls: 2-way normally closed pneumatic spring return modulating control valve with stainless steel trim, TFE seat and packing, sensing bulb, adjustable controller and load anticipator capable of maintaining outlet temperature within 5°F of setpoint over flow range of 3-100% of rated flow. Single solenoid electric hi-limit with automatic reset capable of shutting steam valve on overtemperature. All wiring to be factory packaged, enclosed in control enclosure or conduit.

Accessories: ASME temperature and pressure relief valves sized per CSA ratings, steam and condensate strainers, main and auxiliary steam traps, water thermometer, steam pressure gauge, 1-1/2" fiberglass insulation with painted steel jacketing, painted structural

steel support frame, lifting lugs, bronze 1/12 HP circulator pump with isolation valves and disconnect switch, Type K ASTM B88 copper water piping, Schedule 40 ASTM A53 black steel steam piping, Schedule 80 ASTM black steel condensate piping.

Warranty: Non-prorated 10 year warranty for heat exchanger, tank and controls against any failure. Provide factory warranty with shop drawing submittals and operation and maintenance manuals.

INSTANTANEOUS STEAM WATER HEATER

Manufacturer: Armstrong, Graham, Leslie, Sellers.

Type: Factory fabricated and packaged instantaneous steam to water heater.

Construct and stamp according to Section VIII of the ASME Code for a working pressure of 150 psig.

Design with flanges and unions at steam, condensate and water connections for removal of heat exchanger.

All materials in contact with domestic water are to be non-ferrous. Provide copper/nickel (Cupro-Nickel inside and outside) tube steam bundle (steam in tubes) double wall bundle(s) with nonferrous tube sheet and baffles. Cast iron, ductile iron or steel steam chamber.

Controls: Feed forward differential pressure water blending diaphragm control valve, bronze body, stainless steel or monel proportioning plug and trim, adjustable blend setting, overtemperature safety system, capable of maintaining outlet temperature within +/-4°F of setpoint over flow range of 3-100% of rated flow. Additionally for heaters incorporating hot water return systems, include 2-way normally closed self-contained pilot actuated modulating steam control valve with stainless steel trim, TFE seat and packing, hot water sensing bulb, adjustable thermostatic controller.

Controls for Sellers: 2-way normally closed pneumatic spring return modulating control valve with stainless steel trim, TFE seat and packing, sensing bulb, adjustable controller and load anticipator capable of maintaining outlet temperature within 5°F of setpoint over flow range of 3-100% of rated flow. Single solenoid electric hi-limit with automatic reset capable of shutting steam valve on overtemperature. All wiring to be factory packaged, enclosed in control enclosure or conduit.

Accessories: ASME temperature and pressure relief valves, steam and condensate strainers, main and auxiliary steam traps, water thermometer, steam pressure gauge, painted structural steel support frame. Additional accessories for Sellers: 2" fiberglass insulation with painted steel jacketing, bronze 1/12 HP circulator pump with isolation ball valves and disconnect switch, Type K ASTM B88 copper water piping, Schedule 40 ASTM A53 black steel steam piping, Schedule 80 ASTM black steel condensate piping.

Warranty: Non-prorated 10 year warranty for heat exchanger and vessel against any failure. Provide factory warranty with shop drawing submittals and operation and maintenance manuals.

WATER SOFTENERS

Manufacturers: Amtrol, Capital, Custom-Care, Hellenbrand, Water Right.

Tanks: Fiberglass reinforced mineral tank constructed of molded high density polyethylene inner shell reinforced by exterior fiberglass winding and epoxy resin. NSF approved and rated for 150 psig. Mount slotted or lateral hub PVC distributor in tank with underbedding gravel.

Mineral: High capacity ion exchange mineral, FDA approved, Sybron/Ionac, Rohm & Haas, Resintech or Puralite. Uniform beads rated for removal of 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. Design for minimum 50% resin bed freeboard.

Valve: Top mount brass valve with motor drive, hydraulically balanced piston, seal and spacers, adjustable brine flow control, backwash flow control, adjustable capacity and regeneration settings. Provide bypass ball valve arrangement.

Controls: Factory wired and tested controls with transformer and labeled terminal block for single (*twin, twin alternating, triplex alternating*) consisting of the following:

- 7 Day Time Clock

- Mechanical Demand Meter Delayed Regeneration

- Mechanical Demand Meter Immediate Regeneration

- Electronic Meter and 480 Microprocessor with LED Display for Delayed Regeneration.

- Electronic Meter and 480 Microprocessor with LED Display for Immediate Regeneration.

- Systemax Microprocessor Controller with LED Display

Brine Tank: High density polyethylene brine tank with high salt platform, PVC brine measuring and float valve, PVC injector. Contractor to provide initial salt fill.

Ratings: Maximum 10 MG/L hardness leakage, 110°F maximum operating temperature, 30-100 psig operating pressure, 120/60/1 electrical.

Accessories:

- Flexible braided stainless steel pipe connectors for tanks over 24" in diameter. Inlet and outlet sampling valves, inlet and outlet pressure gauges with shutoff valve.

- Resin defoulant system with chemical metering pump, tubing and 4 month supply of chemical cleaner for iron and bacteria fouling.

WATER SOFTENERS

Manufacturer: Custom Care, Hellenbrand, U.S. Filter or approved equal.

Factory assembled vertical pressure type water softener system shipped with manifold piping attached to the resin tanks for ease of installation and start up.

Tanks: Welded carbon steel pressure vessel according to ASME code, 100 PSI working pressure, 120°F, ASME certified and labeled. Provide structural steel pipe leg supports, top and side 11"x15" handholes and covers. Wire brush tank exterior and apply one coat epoxy mastic for 5-8 mil minimum dry film thickness or abrasive blast and apply 3 coat alkyd finish. Line tank with NSF 61 approved cross linked epoxy-phenolic (Plasite, Tnemec) using alkaline curing agent. Abrasive blast interior to SSPC-SP5 or NACE No.1 white metal surface with 2.5 mil anchor pattern profile. Remove all grit, dust, oil and residue. Prime coat and top coat for 12-15 mil minimum dry film thickness and force cure.

Gravel: Underbedding gravel for distribution system with slotted or lateral hub PVC distributor.

Mineral: High capacity ion exchange mineral, FDA approved, Sybron/Ionac, Rohm & Haas, Resintech or Puralite. Uniform beads rated for removal of 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. Design for minimum 50% resin bed freeboard.

Valves: Multiple Y-type pneumatically air operated diaphragm valves constructed of glass filled thermoplastic cap and body, Buna-N diaphragm and ethylene/propylene seals, rated for 140°F and 125 psi working pressure.

Flow Control Valves: Self-contained pressure compensating flow limiting valves; bronze, stainless steel or PVC construction, rated for 120°F and 125 psi working pressure.

Controls: Factory wired and tested controls with transformer, indicator lights or display for softener and mode, and labeled terminal block for twin alternating (*triplex alternating*) consisting of the following:

Mechanical Demand Meter Delayed Regeneration

Mechanical Demand Meter Immediate Regeneration

Electronic Meter and 480 Microprocessor with LED Display for Delayed Regeneration.

Electronic Meter and 480 Microprocessor with LED Display for Immediate Regeneration.

Brine Tank: High density polyethylene brine tank with high salt platform, PVC brine measuring and float valve, PVC injector. Contractor to provide initial salt fill.

Ratings: Maximum 10 MG/L hardness leakage, 110°F maximum operating temperature, 30-100 psig operating pressure, 120/60/1 electrical.

Piping: Construct interconnecting piping of Schedule 40 galvanized steel, ASTM A53; with threaded, flanged or mechanical grooved class 150 fittings. Factory assemble valve train and piping.

Accessories:

Inlet and outlet sampling valves, inlet and outlet pressure gauges with shutoff valve.

Resin defoulant system with chemical metering pump, tubing and 4 month supply of chemical cleaner for iron and bacteria fouling.

STORAGE TANKS

Manufacturers: A.O. Smith, Bock, Cemline, Lochinvar.

120 gallon vertical (*horizontal*) glass or cement lined non-fired steel storage tank rated for 150 psig and complete with magnesium anode rod, minimum R-12.5 insulation, painted steel jacket, inlet and outlet fittings, ASME T&P relief valve and drain valve.

STORAGE TANKS

Manufacturers: Ace Buehler, Adamson, Cemline, Patterson-Kelley, Reco, Wessels.

Horizontal (*vertical*) steel storage tank; ASME rated and stamped for 150 psig working pressure; complete with nonferrous inlet, outlet, return, relief and drain fittings; ASME T&P relief valve; steel saddles (*pipe or angle legs*); gasketed 11"x15" inspection manhole lined same as tank. Wire brush tank exterior and apply one coat epoxy mastic for 5-8 mil minimum dry film thickness or abrasive blast and apply 3 coat alkyd finish. Line tank with hydraulic cement suitable for use with soft water.

Warranty: Non-prorated 5 year warranty for tank against any failure. Provide factory warranty with shop drawing submittals and operation and maintenance manuals.

SUMPS

Fiberglass sump basin constructed of 25-30% fiberglass and 70-75% polyester resin with no fillers; minimum design safety factor of four; complete with tapped top flange; side hub fittings; bolted galvanized steel or aluminum (*fiberglass*) gasketed cover with inspection access plate, access plate with discharge pipe flange for each pump and control and vent flange where required. Minimum sump wall thickness as follows:

Wall Thickness (Inches)

<u>Diameter</u>	<u>24</u>	<u>30</u>	<u>36</u>	<u>42</u>	<u>48</u>	<u>60</u>	<u>72</u>
Max. 10' Depth	3/16	1/4	1/4	1/4	5/16	5/16	3/8
Max. 15' Depth	1/4	5/16	5/16	5/16	3/8	3/8	7/16
Max. 20' Depth	5/16	5/16	3/8	3/8	7/16	1/2	1/2

Precast reinforced concrete manhole sections, ASTM C478. Construct base of 6" thick precast reinforced concrete or 8" thick cast in place concrete. Construct top of precast reinforced concrete or 6" thick reinforced concrete slab. Seal between sections with rubber ring gaskets, ASTM C443, or plastic preformed gasket material. Seal pipe penetrations with flexible watertight rubber gasketed seals. Provide bolted galvanized steel or aluminum gasketed cover with inspection access plate, access plate with discharge pipe flange for each pump and control and vent flange where required.

ACID NEUTRALIZATION TANKS

Manufacturer: R&G Sloane, Schier, Town & Country Plastics

Vertical cylindrical tank and cover constructed of ASTM D2146-65T polypropylene; with male threaded (*flanged*) inlet, outlet and vent fittings; trapped inlet (*outlet*) fitting; flanged and gasketed cover with 11" inspection manhole for covers over 30" in diameter; 1"-3" diameter limestone chip fill of minimum 90% calcium carbonate content.

SUMP PUMPS

Manufacturer: Aurora/Hydromatic, Gould, Little Giant, Myers, Paco, Stancor, Sta-Rite, Weil, Zoeller.

Type: Submersible pumps constructed of epoxy coated cast iron shell, cast iron volute, two vane enclosed (*semi-open, or recessed vortex*) non-clog cast iron, bronze or thermoplastic impeller, stainless steel shaft, stainless steel fasteners, upper and lower ball bearings, oil lubricated or factory sealed grease lubricated, and ceramic mechanical seal.

Motor: Hermetically sealed, capacitor start, with built-in thermal overload protection sized for non-overloading over the entire pump curve.

CONTROLS

1. Single On/Off float switch, UL listed.
2. Double (one On, one Off) float switch, UL listed.
3. Triple (1st pump On, 2nd pump on, both pumps Off) float switch, UL listed.
4. Four (1st pump On, 2nd pump on, both pumps Off, high level alarm) float switches, UL listed.
5. NEMA 1 indoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
6. NEMA 4X outdoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
7. Combination magnetic starter with fused disconnect switch, HOA switch, run light, resettable overload heaters, NEMA 1 (*NEMA 4*), UL listed.
8. Mechanical pump alternator with mechanical switch and float mechanism for control of 1st pump On, 2nd pump On, both pumps Off and alarm, with alarm panel, warning light, horn, silence switch, test switch, NEMA 1. (*NEMA 4*)
9. Electrical pump alternator and alarm panel with combination magnetic starter for each pump, fused disconnect switch, HOA switch for each pump, run

light for each pump, resettable overload heaters, warning light, horn, silence switch, test switch, labeled terminal switch and devices, auxiliary dry contact for remote alarm, UL listed components, NEMA 1 (*NEMA 4*).

ACCESSORIES

1. 10' power cord.
2. 20' power cord.
3. NEMA 4 junction box.
4. Discharge check valve, fullport ball valve and union for each pump.
5. Dual mechanical seals, seal leak detector probe and warning light in control panel.
6. Dual stainless steel lift out guide rails with stainless steel wall, pump and sump brackets, bronze and neoprene quick disconnect fitting and corrosion proof pull chain or cable.

SEWAGE EJECTOR PUMPS

Manufacturer: Aurora/Hydromatic, Gould, Paco, Stancor, Sta-Rite, Weil, Zoeller.

Type: Submersible sewage ejector pumps constructed of epoxy coated cast iron shell, cast iron volute, semi-open (*recessed vortex*) non-clog bronze or cast iron impeller with top pump out vanes, stainless steel shaft, stainless steel fasteners, upper and lower ball bearings oil lubricated or factory sealed grease lubricated, and ceramic mechanical seal.

Motor: Hermetically sealed, capacitor start, Class B (*F*) insulation, with built-in thermal overload protection sized for non-overloading over the entire pump curve.

CONTROLS

1. Single On/Off float switch, UL listed.
2. Double (one On, one Off) float switch, UL listed.
3. Triple (1st pump On, 2nd pump on, both pumps Off) float switch, UL listed.
4. Four (1st pump On, 2nd pump on, both pumps Off, high level alarm) float switches, UL listed.
5. NEMA 1 indoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
6. NEMA 4X outdoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
7. Combination magnetic starter with fused disconnect switch, HOA switch, run light, resettable overload heaters, NEMA 1 (*NEMA 4*), UL listed.
8. Mechanical pump alternator with mechanical switch and float mechanism for control of 1st pump On, 2nd pump On, both pumps Off and alarm, with alarm panel, warning light, horn, silence switch, test switch, NEMA 1. (*NEMA 4*)
9. Electrical pump alternator and alarm panel with combination magnetic starter for each pump, fused disconnect switch, HOA switch for each pump, run light for each pump, resettable overload heaters, warning light, horn, silence

switch, test switch, labeled terminal switch and devices, auxiliary dry contact for remote alarm, UL listed components, NEMA 1 (*NEMA 4*).

10. Class 1, Group D, Division 1 explosion proof rated controls and switches.
11. Elapsed time meters.

ACCESSORIES:

1. 10' power cord.
2. 20' power cord.
3. 30' power cord.
4. NEMA 4 junction box.
5. Discharge cast iron weighted check valve, fullport ball or gate valve and union or flange for each pump.
6. Dual mechanical seals, seal leak detector probe and warning light in control panel.
7. Dual stainless steel lift out guide rails with stainless steel or cast iron wall, pump and sump brackets, bronze and neoprene quick disconnect fitting and corrosion proof pull chain or cable.
8. Explosion proof Class 1, Group D, Division 1 motor.

IN-LINE CENTRIFUGAL PUMPS

Manufacturer: Bell and Gossett, Gould, Grundfos, Taco.

Type: Horizontal single stage oil lubricated in-line pumps, 125 psig maximum working pressure at operating temperature of 225°F. continuous. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.

Casing: Bronze or stainless steel; flanged suction and discharge connection.

Impeller: Brass or bronze, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

Bearings: Oil lubricated bronze sleeve or ball bearings.

Shaft: Stainless steel or carbon steel with stainless steel or bronze sleeve, integral thrust collar.

Seal: Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

Drive: Flexible coupling.

Motor: Provide pump with open dripproof motor with built-in thermal overload protection sized for non-overloading over the entire pump curve. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

IN-LINE CLOSE COUPLED CENTRIFUGAL PUMPS

Manufacturer: Bell and Gossett, Gould, Grundfos, Taco.

Type: Horizontal single stage close coupled oil lubricated in-line pumps, 125 psig maximum working pressure at operating temperature of 225°F. continuous. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.

Casing: Bronze or stainless steel; flanged suction and discharge connection.

Impeller: Brass, bronze or thermoplastic, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

Bearings: Oil lubricated bronze sleeve or ball bearings.

Shaft: Stainless steel or carbon steel with stainless steel or bronze sleeve, integral thrust collar.

Seal: Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

Motor: Provide pump with open dripproof motor with built-in thermal overload protection sized for non-overloading over the entire pump curve. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

IN-LINE SYSTEM LUBRICATED CENTRIFUGAL PUMPS

Manufacturer: Bell and Gossett, Grundfos, Taco.

Type: Horizontal single stage close coupled system lubricated in-line pumps, 125 psig maximum working pressure at operating temperature of 225°F. continuous. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.

Casing: Bronze or stainless steel; flanged suction and discharge connection.

Impeller: Bronze, stainless steel or thermoplastic, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

Bearings: System lubricated carbon sleeve bearings.

Shaft: Stainless steel or ceramic.

Seal: Stainless steel can isolating rotor and stator.

Motor: Provide pump with impedance protected motor sized for non-overloading over the entire pump curve. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

DOMESTIC WATER BOOSTER PUMPS

Manufacturer: Aurora, Bell and Gossett, Paco, Systecon, Taco, Weil.

General: Factory packaged duplex (*triplex*) domestic water booster pumps with all components fully frame mounted, piped, painted, wired and tested at factory.

Type: Vertical close-coupled end suction pumps, 125 psig maximum working pressure at operating temperature of 225°F. continuous. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.

Casings: Top pullout design with gray iron volute, backplate and bronze wearing rings.

Impellers: Brass or bronze, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

Shafts: Stainless or carbon steel with stainless steel or bronze sleeve, integral thrust collar.

Seals: Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

Motors: Provide pumps with open dripproof motor sized for non-overloading over the entire pump curve. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

Pressure Regulating Valves: Cast iron body, bronze fitted, hydraulically operated, pilot controlled diaphragm globe type combination pressure regulating non-slam check valve at each pump discharge.

Isolation Valves: Butterfly or ball valves at inlet and outlet of each pump.

Manifold Piping: Galvanized schedule 40 steel (*Type "L" copper*), flexible suction and discharge braided pipe connectors, suction and discharge pressure gauges and common thermal relief valve piped to floor drain.

Controls: Current sensing control mounted in UL labeled NEMA 1 control panel with the following components: magnetic across the line motor starters with 3 leg overload protection and external resets, starter failure interlocks, H-O-A switches for each pump, single door interlocked disconnect with individual fuses, control circuit transformer with protected secondary, time delays, minimum run timers, adjustable solid state current

sensing relays, low suction pressure cutout, pump 2 & 3 automatic alternation, high suction pressure shutdown, 2 sensor differential temperature no-flow shutdown, operating and warning lights, warning alarm.

EXPANSION TANKS

Manufacturer: Amtrol, Bell and Gossett, Wessels.

Vertical steel precharged hydro-pneumatic expansion tank, 125 psi ASME labeled construction, complete with replaceable flexible butyl rubber bladder, system connection fitting, Schrader type air charge fitting, steel base ring stand, factory prime and enamel painted exterior finish, ASME relief valve. Materials exposed to water to be NSF or FDA approved for potable water service.

PART 3 - EXECUTION

INSTALLATION

Install plumbing equipment where indicated according to manufacturer's recommendations. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

Set commercial water heaters, commercial water softeners, storage tanks and booster pumps on concrete housekeeping pads. Adjust and level equipment.

Set sumps on compacted granular backfill adjusting for plumb and level. Backfill in even layers around sump with granular backfill.

Connect equipment to water and drain piping using unions or flanges and isolation valves.

Connect pneumatic controls to compressed air source.

Size temperature and relief valves per CSA ratings. Pipe temperature and pressure relief valves to floor drain or floor as indicated.

Startup and test equipment adjusting operating and safety controls for proper operation.

Cycle softeners and adjust for specified exchange rate, regeneration time, consumption, backflow rate, etc. Provide initial salt fill of brine tank.

Lubricate pumps before startup. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.

Adjust compression tank precharge to scheduled minimum operating pressure prior to connecting to system.

END OF SECTION 22 30 00

The following are examples of the kind of information that should be included in equipment schedules on the drawings.

Residential Gas Fired Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Input</u> <u>BTUH</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>
WH1				

Power Vented Gas Fired Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Input</u> <u>BTUH</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>
WH2				

Commercial Atmospheric Gas Fired Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Input</u> <u>BTUH</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>
WH3				

Commercial Powered Gas Fired Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Input</u> <u>BTUH</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>
WH4				

High Efficiency Commercial Gas Fired Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Input</u> <u>BTUH</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>
WH5				

High Efficiency Stainless Steel Commercial Gas Fired Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Input</u> <u>BTUH</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>
WH6				

High Efficiency Copper-Nickel Tube Gas Fired Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Input</u> <u>BTUH</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>
WH7				

Copper Fin Gas Fired Water Heater Schedule

<u>No.</u>	<u>Input</u> <u>BTUH</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>
WH8			

Residential Electric Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Input</u> <u>Watts</u>	<u>Recovery</u> <u>GPH</u>	<u>°F Temperature</u> <u>Rise</u>	<u>Volts/Phase</u>

WH9

Semi-Instantaneous Steam Water Heater Schedule

Storage Steam Water Heater Schedule

<u>No.</u>	<u>Volume</u> <u>Gallons</u>	<u>Steam Pressure</u> <u>Before Valve</u>	<u>Inlet Water</u> <u>°F</u> <u>Temperature</u>	<u>Outlet Water</u> <u>°F</u> <u>Temperature</u>	<u>Pressure</u> <u>Drop</u> <u>GPM Feet</u>
WH11	_____				

Instantaneous Steam Water Heater Schedule

<u>No.</u>	<u>Steam Pressure</u> <u>Before Valve</u>	<u>Inlet Water</u> <u>°F Temperature</u>	<u>Outlet Water</u> <u>°F Temperature</u>	<u>Pressure Drop</u> <u>GPM Feet</u>
WH12				

Water Softener Schedule (Each Vessel)

<u>No.</u>	<u>Normal</u> <u>Flow/PD</u> <u>GPM/PSI</u>	<u>Maximum</u> <u>Flow/PD</u> <u>GPM/PSI</u>	<u>Exchange Setting</u> <u>per Cu.Ft. of Resin</u> <u>Grains/Lbs Salt</u>	<u>Flow Between</u> <u>Regenerations Flow</u> <u>Gallons GPM</u>	<u>Backwash</u> <u>Resin</u> <u>Cu.Ft.</u>
SF-1	____/____	____/____	____/____	____/____	____/____

Water Softener Schedule (Cont'd.)

<u>No.</u>	<u>No. of</u> <u>Softeners</u>	<u>Pipe</u> <u>Dia./Height</u> ____"/____"	<u>Brine Maker</u> <u>Size</u> ____"	<u>No.</u>	<u>Size</u> ____"	<u>Water Meter</u> <u>Capacity</u> ____Gal.	<u>No.</u>	<u>Size</u> ____"
SF-1	____			____			____	

Storage Tank Schedule:

<u>No.</u>	<u>Service</u>	<u>Volume</u> ____Gallons	<u>Diameter</u> ____"	<u>Length(Height)</u> ____"
ST-1	Hot Water			

Sump Schedule:

<u>No.</u>	<u>Service</u>	<u>Volume</u> ____Gallons	<u>Diameter</u> ____"	<u>Height</u> ____"
SU-1	Sanitary			

Dilution Tank Schedule:

<u>No.</u>	<u>Service</u>	<u>Volume</u> ____Gallons	<u>Diameter</u> ____"	<u>Min.</u> <u>Height</u> ____"	<u>Wall Thickness</u>
DT-1	Lab Waste				

Sump Pump Schedule:

<u>No.</u>	<u>Service</u>	<u>Flow (Each)</u> ____GPM	<u>Head</u> ____'	<u>Disch.</u> ____"	<u>Solids</u> ____"	<u>Motor</u> ____HP	<u>RPM</u>	<u>Voltage</u> 120/60/1
SP1 & 2	Storm							

Sewage Ejector Pump Schedule:

<u>No.</u>	<u>Service</u>	<u>Flow (Each)</u> ____GPM	<u>Head</u> ____'	<u>Disch.</u> ____"	<u>Solids</u> ____"	<u>Motor</u> ____HP	<u>RPM</u>	<u>Voltage</u> 120/60/1
SEP1&2	Sanitary							

Inline Pump Schedule

<u>No.</u>	<u>Service</u>	<u>Flow</u>	<u>Head</u>	<u>Motor</u>	<u>RPM</u>	<u>Voltage</u>
P1	Hot Water	___ GPM	___'	___ HP	___	120/60/1
P2	Hot Water	___ GPM	___'	___ HP	___	208/60/3

Inline Close Coupled Pump Schedule

<u>No.</u>	<u>Service</u>	<u>Flow</u>	<u>Head</u>	<u>Motor</u>	<u>RPM</u>	<u>Voltage</u>
P3	Hot Water	___ GPM	___'	___ HP	___	120/60/1
P4	Hot Water	___ GPM	___'	___ HP	___	208/60/3

Inline System Lubricated Pump Schedule

<u>No.</u>	<u>Service</u>	<u>Flow</u>	<u>Head</u>	<u>Motor</u>	<u>RPM</u>	<u>Voltage</u>
P5	Hot Water	___ GPM	___'	___ HP	___	120/60/1
P6	Hot Water	___ GPM	___'	___ HP	___	208/60/3

Booster Pump Schedule

<u>No.</u>	<u>Load %</u>	<u>Flow</u>	<u>Suct Head</u>	<u>Disch Head</u>	<u>Motor</u>	<u>RPM</u>	<u>Voltage</u>
BP1	20	___ GPM	___'	___'	___ HP	___	208/60/3
BP2	40	___ GPM	___'	___'	___ HP	___	208/60/3
BP3	40	___ GPM	___'	___'	___ HP	___	208/60/3

Compression Tank Schedule

<u>No.</u>	<u>Min. Operating Pressure</u>	<u>Max. Operating Pressure</u>	<u>Acceptance Volume</u>	<u>Total Volume</u>	<u>Height</u>	<u>Diam.</u>
CP1	___ PSIG	___ PSIG	___ Gallons	___ Gallons	___"	___"

Total Volume Calculation: $V_{total} = V_{acceptance} / [1 - (Min.P + 14.7 / Max.P + 14.7)]$

SECTION 22 42 00 – COMMERCIAL PLUMBING FIXTURES

PART 1 – GENERAL

SCOPE

This section includes specifications for plumbing fixtures, faucets and trim.

RELATED WORK

Section 22 11 00 - Facility Water Distribution

Section 22 13 00 - Facility Sanitary Sewerage

Section 22 14 00 - Facility Storm Drainage

Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

Section 22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

Plumbing products requiring approval by the State of Wisconsin Dept. of Safety and Professional Services must be approved or have pending approval at the time of shop drawing submission.

SHOP DRAWINGS

Include data concerning sizes, utility sizes, rough in-dimensions, capacities, materials of construction, ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

ANSI A112.6.1M-88	Supports for Off-the Floor Plumbing Fixtures for Public Use.
ANSI A112.18.1-94	Finished and Rough Brass Plumbing Fixture Fittings.
ANSI A112.19.1-90	Enameled Cast Iron Plumbing Fixtures.
ANSI A112.19.2M-82	Vitreous China Plumbing Fixtures.
ANSI A112.19.5-79(R1990)	Trim for Water Closet Bowls, Tanks and Urinals.
ANSI Z124.1-87	Plastic Bathtub Units.
ANSI Z124.2-87	Plastic Shower Receptors and Shower Stalls.

ARI-1010-94	Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
ASSE 1011-93	Hose Connection Vacuum Breakers.
ASSE 1014-90	Handheld Showers.
ASSE 1035-93	Laboratory Faucet Backflow Preventers.

ENERGY EFFICIENCY REQUIREMENTS

Plumbing fixtures must meet the following maximum water usage requirements which are based upon Federal Energy Management Program (FEMP) performance requirements.

1. Lavatory Faucets, flow of 2 gpm or less and .25 gallon per cycle or less (based on inlet pressure of 60 p.s.i.)
2. Showerheads, flow of 2.2 gpm or less (based on inlet pressure of 80 p.s.i.)
3. Urinal Flush Valves, 1.0 gallon per flush or less.
4. Water Closet Flush Valves, 1.6 gallon per flush or less.

PART 2 - PRODUCTS

PLUMBING FIXTURES

Manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted.

1. Water Closets - American Standard, Kohler, Zurn.
2. Water Closet Seats - Bemis, Beneke, Centoco, Olsonite Sperzel.
3. Urinals – American Standard, Kohler, Zurn.
4. Lavatories – American Standard, Kohler, Zurn.
5. Faucets - Chicago Faucet, Kohler, Speakman, Symmons, Zurn.
6. Drains - Chicago Faucet, Engineered Brass Co., Kohler, McGuire.
7. Stops and Supplies - Chicago Faucet Co., McGuire. (Heavy Duty Type Only)
8. Flush Valves - Coyne & Delany, Sloan Royal, Zurn AV.
9. Traps - Kohler, McGuire, Dearborn, Engineered Brass Co. (17 gauge Min.)
10. Carriers and Supports - Josam, Smith, Wade, Watts Drainage, Zurn.
11. Washfountains - Acorn, Bradley.
12. Sinks - American Standard, Elkay, Just, Kohler.
13. Laundry Trays - Fiat, Mustee, Stern-Williams.
14. Service Sinks - American Standard, Crane, Kohler.
15. Mop Basins - Fiat, Mustee, Stern-Williams.
16. Showers - Leonard, Powers, Speakman, Symmons.
17. Multiple Showers - Acorn, Bradley, Willoughby.
18. Bathtubs - American Standard, Crane, Kohler.
19. Molded Tub and Shower Units – Aker, Aqua Glass, Fiat, Kohler, Lasco.
20. Drinking Fountains - Elkay, Halsey Taylor, Haws, Filtrine, Oasis, Sunroc.
21. Drinking Fountains (China) - American Standard, Crane, Kohler, Sunroc.

22. Electric Water Coolers - Elkay, Halsey Taylor, Haws, Filtrine, Oasis, Sunroc.
23. Security Fixtures - Acorn, Bradley, Metcraft, Willoughby.
24. Emergency Eyewash Fountains and Showers - Bradley, Chicago Faucet Co., Guardian, Haws, Speakman.

WATER CLOSETS

WC-1 - Wall hung back outlet white vitreous china siphon jet water closet with elongated bowl, 1-1/2" top spud, 2-1/4" passageway and 1.6 gallon flush. Flush valve handle 22" above rim.

Fixture: Kohler Kingston K-4330.
Flush Valve: Sloan Royal 116-1.5-YK.
Seat: Bemis 1655-SS/C white solid plastic open front.
Carrier: Smith commercial grade adjusted for 15" bowl height.

WC-2 - Same as WC-1, barrier free adjusted for 16-1/2" bowl height. Operating handle of the flush valve to be ADA compliable for activation force and located to the wide side of the stall. Flush valve handle 13" above rim.

Flush Valve: Sloan Royal 113-1.5-YK.

WC-3 - Floor mount bottom outlet white vitreous china siphon jet water closet with elongated bowl, 1-1/2" top spud, 2-1/4" passageway, 15" rim height and 1.6 gallon flush. Flush valve handle 24" above rim.

Fixture: Kohler Wellcome K-4349.
Flush Valve: Sloan Royal 116-1.5-YK.
Seat: Bemis 1655-SS/C white solid plastic open front.

WC-4 - Floor mount bottom outlet white vitreous china siphon jet water closet with elongated bowl, 1-1/2" top spud, 2-1/4" passageway, 16-1/2" rim height and 1.6 gallon flush. Flush valve handle 13" above rim, located to the wide side of the stall and be ADA compliable for activation force.

Fixture: Kohler Highcrest K-4302.
Flush Valve: Sloan Royal 113-1.5-YK.
Seat: Bemis 1655-SS/C white solid plastic open front.

WC-5 - Floor mount bottom outlet white vitreous china siphon jet close coupled tank water closet with elongated bowl, 2-1/4" passageway, 14-1/2" rim height, insulating tank liner and 1.6 gallon flush.

Fixture: Kohler Wellworth K-3422-U.
Seat: Bemis 1655-SS/C white solid plastic open front seat.
Supply & Stop: Chicago Faucet Co. No. 1013-CP w/ 3/8" closet riser.

WC-6 - Floor mount bottom outlet white vitreous china siphon jet close coupled tank type water closet with elongated bowl, 2-1/4" passageway, 16-1/2" barrier free height, insulating tank liner and 1.6 gallon flush. ADA compliable.

Fixture: Kohler Highline K-3427-U.
Seat: Bemis 1655-SS/C white solid plastic open front seat.
Supply & Stop: Chicago Faucet Co. No. 1013-CP w/ 3/8" closet riser.

URINALS

UR-1 - Wall mount white vitreous china washout urinal with 3/4" top inlet spud, 2" outlet, removable strainer. Battery powered sensor operated flush valve, 1 gallon per flush or less.

Fixture: Kohler Bardon K-4960-T.
Flush Valve: Sloan Royal 8186-1.
Carrier: Smith commercial grade adjusted for 24" lip height.

UR-2 - Same as UR-1, barrier free adjusted for 16" lip height. Flush valve handle to be ADA compliant.

UR-3 - Floor mount white vitreous china washout urinal with 3/4" top inlet spud, 2" outlet spud, removable stainless steel beehive strainer. Battery powered sensor operated flush valve 1 gallon per flush or less.

Fixture: Kohler Branham K-4920-T.
Flush Valve: Sloan Royal 8186-1.

LAVATORIES

Lavatory faucets must meet maximum water usage requirements of 2 gpm flow or less and .25 gallon per cycle or less (based on inlet pressure of 60 p.s.i.)

L-1 - Wall mount white vitreous china lavatory drilled for concealed arm carrier with 4" on center faucet openings.

Fixture: Kohler Greenwich K-2027.
Faucet: Chicago Faucet No.802-336CP. Self-closing.
Drain: Kohler K-7715 perforated strainer and 1-1/4" tailpiece.
Trap: 1-1/4"x1-1/2" 17 ga. cast brass trap and tubular wall bend. With C.O. plug.
Supplies &
Stops: Chicago Faucet No. 1017CP.
Carrier: Smith floor mounted concealed arm carrier adjusted for 31" height rim ht.

L-2 - Wall mount barrier free white vitreous china lavatory drilled for concealed arm carrier with 4" on center faucet openings.

Fixture: Kohler Kingston K-2005.
Faucet: Chicago Faucet No.802-336CP. Self-closing.
Drain: Kohler K-13885 perforated strainer and 1-1/4" offset tailpiece.
Trap: 1-1/4"x1-1/2" 17 ga. cast brass trap and tubular wall bend. With C.O. plug.
Supplies & Stops: Chicago Faucet No. 1017CP.
Carrier: Smith floor mounted concealed arm adjusted for 34" height.

L-3 - Self-rimming counter mount white vitreous china lavatory with 4" on center faucet openings.

Fixture: Kohler Pennington K-2195.
Faucet: Chicago Faucet No. 802-336CP. Self-closing.
Drain: Kohler K-7715 perforated strainer and 1-1/4" tailpiece.
Trap: 1-1/4"x1-1/2" 17 ga. cast brass trap and tubular wall bend. With C.O. plug.
Supplies & Stops: Chicago Faucet No. 1017CP.

L-4 - Same as L-3, barrier free with the following drain:

Drain: Kohler K-13885 perforated strainer and 1-1/4" offset tailpiece.

WASHFOUNTAINS

WF-1 - Floor mounted precast terrazzo 3 station washfountain with stainless steel access panel, floor and bowl anchor brackets, supply stops, strainers, check valves, thermostatic mixing valve, flow restrictors, infrared sensors, solenoid valves and transformer. Color to be selected by Architect/Engineer from manufacturers standard color selection.

Fixture: Bradley 2903.
Trap: 2"x2" 17 ga. cast brass trap.
Stops: Ball valves

SINKS

S-1 - Counter mounted 18 ga type 302 stainless steel single compartment sink with 3 faucet openings 4" on center.

Fixture: Elkay LR-2219.
Faucet: Chicago Faucet No. 201ACP.
Drain: Elkay LK-335
Trap: 1-1/2"x1-1/2" 17 ga. cast brass trap and tubular wall bend, With C.O. plug.
Supplies & Stops: Chicago Faucet No. 1013-CP w/ 3/8" riser, length as necessary.

S-2 - Counter mounted 18 ga. type 302 stainless steel double compartment sink with 3 faucet openings 4" on center.

Fixture: Elkay LR-3322.
Faucet: Chicago Faucet No. 201ACP.
Drains: Elkay LK-335
Waste McGuire No. 113C16G17, Center outlet, 17 ga.
Traps: 1-1/2"x1-1/2" 17 ga. cast brass trap and tubular wall bend.
Supplies & Stops: Chicago Faucet No. 1013-CP w/ 3/8" riser, length as necessary.

LAUNDRY TRAYS

LT-1 - Wall and floor mounted molded polyester resin and stone single compartment laundry tray with wall bracket and painted steel legs. Secure to wall and floor.

Fixture: Fiat FL-1 / L-1.
Faucet: Chicago Faucet No. 891CP.
Supplies & Stops: Chicago Faucet No.1013-CP w/ 3/8" risers, length as necessary.
Trap: 1-1/2"x1-1/2" 17 ga. cast brass trap and tubular wall bend, with tailpiece.

LT-2 - Wall and floor mounted molded polyester resin and stone double compartment laundry tray with wall bracket and painted steel legs, with dual waste outlet. Secure to wall and floor.

Fixture: Fiat FLTD / LTD.

Faucet: Chicago Faucet No. 891CP.

Supplies & Stops: Chicago Faucet Co. 1013-CP w/ 3/8" risers, length as necessary.

Trap: 1-1/2"x 1-1/2" 17 ga. cast brass trap and tubular wall bend, with tailpiece.

LT-3 - Countertop mounted double compartment white enameled cast iron laundry sink, 3-hole, 43"x21", right compartment 13" deep & left compartment 8" deep, with metal mounting frame and strainer/stoppers.

Fixture: Kohler Westover K-6629.

Faucet: Chicago Faucet No. 201ACP.

Supplies & Stops: Chicago Faucet No. 1013-CP w/ 3/8" risers, length as necessary.

Traps: (2) 1-1/2"x1-1/2" 17 ga. cast brass trap and tubular wall bend, with tailpiece.

SERVICE SINKS

SS-1 - Wall mounted enameled cast iron service sink with stainless steel rim guard and wall hanger supports.

Fixture: Kohler Bannon K-6719.

Faucet: Chicago Faucet No. 897RCF with Watts 8BC vacuum breaker.

Drain: Kohler K-6673 3" trap with strainer, cleanout and floorplate.

Stops: (Integral with faucet)

MOP BASINS

MB-1 - Floor mounted molded polyester resin and stone mop basin, 24"x36"x10" H, with 3" drain, stainless steel strainer and vinyl bumper guards.

Fixture: Fiat MSB-3624.

Faucet: Chicago Faucet No. 897RCF with Watts 8BC vacuum breaker.

Hose: Fiat 832-AA.

Stops: (Integral with faucet)

MB-2 - Floor mounted precast terrazzo mop basin, 24"x24", with 3" drain, stainless steel strainer and stainless steel curb caps.

Fixture: Fiat TSB-100.

Faucet: Chicago Faucet No. 897RCF with Watts 8BC vacuum breaker.

Hose: Fiat 832-AA.

Stops: (Integral with faucet)

SHOWERS

SH-1 - Pressure balanced shower valve with ceramic valving, check stops, adjustable temperature limit stop and volume control. Brass balljoint showerhead with spray adjustment, 6 lexan plungers, supply pipe and escutcheon.

Valve: Speakman SM-1427-SCS.

Shower Head: Speakman S-2252 AF. (2.2 gpm @ 80 psi)

Shower Arm: Speakman S-2520.

SH-2.-.Pressure balanced shower valve with ceramic valving, check stops, adjustable temperature limit stop and volume control, Lever handle operated. With lever operated diverter valve, stationary shower head and hand-held adjustable head with 44" slide bar , 72" hose, in-line vacuum breaker and supply elbow. ADA compliant.

Valve: Speakman SM-1427-SCS.
Shower Head: Speakman S-2270-AF. (2.2 gpm @ 80 psi)
Shower Arm: Speakman S-2500.
Diverter: Speakman S-1182.
Hand Held Head: Speakman VS-100-AF/VS-124/VS117.
Supply Ell: Speakman VS-115.
Hose: Speakman VS-142.

MULTIPLE SHOWERS

SH-COL-1 - Floor to ceiling type 304 stainless steel construction 6 station column shower with column cap, telescoping shroud, integral cast iron drain fitting, soap tray, individual pressure balanced mixing valves, severe service shower heads with 2.0 GPM flow restrictors and stops in main supplies.

Fixture: Bradley 6CO-6'-0"-EF-SH-ST-SX.

W-SH-1 - Wall mounted 18 ga. stainless steel construction shower panel for (3) users, with mounting brackets, severe service shower heads, 2.0 GPM flow controlled, pressure balanced mixing valves, soap dishes, and stops in supplies.

Fixture Bradley 3W-6'-0"-EF-ST-SX.

BATHTUBS

BT-1 - Enameled cast iron bathtub with non-slip floor finish and pop-up drain.

Fixture: Kohler Mendota K-505/506.
Drain: Kohler K-7160 1-1/2" drain.
Valve: Speakman SM-1427-SCS.
Shower Head: Speakman S-2252-AF/S-2520 (2.2 gpm @ 80 psi)
Faucet: Speakman S-1555.

MOLDED SHOWER UNIT

MS-1 - One piece acrylic barrier free molded shower unit with dome ceiling, non-slip floor finish, grab bars, fold-up seat and 2" drain. Set unit into floor construction to maintain ADA required 1/2" threshold.

Fixture: Kohler Freewill K-12100/12101.
Drain: Kohler K-9132 2" drain with strainer.
Valve: Speakman SM-1427-SCS.
Shower Head: Speakman S-2252-AF/S-2520 (2.2 gpm @ 80 psi)

MTS-1 - One piece acrylic molded tub and shower unit with dome ceiling, non-slip floor finish, grab bar and pop-up drain.

Fixture: Kohler Sonata K-1561.
Drain: Kohler K-7161-AF 1-1/2" drain.

Valve: Speakman SM-1427-SCS.
Shower Head: Speakman S-2252-AF/S-2520 (2.2 gpm @ 80 psi)
Faucet: Speakman S-1555.

DRINKING FOUNTAINS

DF-1 - Wall mounted barrier free stainless steel drinking fountain with self-closing front mounted push bar valve, wall hanger, 3/8" supply and 1-1/4" tailpiece. Mount at 36" spout height. Provide wall access panel for access to trap and stop.

Fixture: Elkay EDFPW-114C.
Trap: 1-1/4"x1-1/4" 17 ga. cast brass trap.
Stop: 3/8" ball valve (concealed).

DRINKING FOUNTAINS (CHINA)

DF-2 - Wall mounted barrier free white vitreous china drinking fountain with self-closing lever handle valve, screwdriver stop, chrome strainer and wall hanger. Mount at 36" spout height.

Fixture: Kohler Serra K-5250-A.
Drain & Trap: Kohler K-9047.

ELECTRIC WATER COOLERS

EWC-1 - Wall mounted barrier free electric water cooler with stainless steel basin, self-closing front and side mounted push bars, wall hanger and 1-1/4" tailpiece, rated for 7.6 GPH at 80 degree inlet water, 90 degree ambient and 50 degree leaving water, 400 watts, 120/60/1. Color to be selected by Architect/Engineer from manufacturers standard color selection. Mount at 36" spout height.

Fixture: Elkay EHFS-8.
Trap: 1-1/4"x1-1/4" 17 ga. cast brass trap.
Stop/Supply: Chicago Faucet Co. 1013-CP or 1/2" ball valve with 3/8" riser (concealed).

EWC-2 - Wall mounted barrier free drinking fountain with stainless steel basin, self-closing front mounted push bar, wall hanger and 1-1/4" tailpiece, rated for 8.1 GPH at 80 degree inlet water, 90 degree ambient and 50 degree leaving water, 270 watts, 120/60/1. Color to be selected by Architect/Engineer from manufacturers standard color selection. Mount at 36" spout height.

Fixture: Elkay EBFSA-8.
Trap: 1-1/4"x1-1/4" 17 ga. cast brass trap.
Stop/Supply: Chicago Faucet Co. no. 1013-CP or 1/2" ball valve with 3/8" riser (concealed).

EWC-3 - Dual level, wall mounted, barrier free and standard height, stainless steel finish water cooler/drink fountain station with front pushbar operators. Single recessed steel mounting box with refrigeration system and stainless steel removable front grille for access. Rated for 8.0GPH at 80 degree inlet water at 90 degree ambient temperature and 50 degree outlet water., 1/5 HP compressor, 380 watt, 120/60/1. Mount so upper unit spout is at 40" above floor.

Fixture: Elkay LKTE-8
Traps: 1 1/4"x1 1/4" 17 ga. cast brass, with C.O. plug.
Stops: 1/2" ball valve with 1/2" riser (concealed).

SECURITY FIXTURES

WCL-1 - Floor mounted wall outlet Type 304 stainless steel combination water closet and lavatory with angled elongated blowout water closet, 2-5/8" passageway, rustproofed concealed wall anchoring fasteners and sound deadening interior coating. Completely factory pipe and wire fixture for final water, waste and electrical field connections. Minimum metal thicknesses are 16 gauge trap; 14 gauge lavatory bowl, countertop, backsplash, toilet bowl, seat, flushing rim, waste flange and trap covers; 12 gauge cabinet. Fully weld joints and finish exposed surfaces to #4 satin finish and seat to #7 finish. Submit test data indicating no deflection under 2000 lb. load and no permanent deflection under 5000 lb. load on front area of water closet.

Fittings: 24 volt hot and cold lav and cold water closet solenoid valves, stainless steel pushbutton operators with keyed escutcheons and concealed micro switches, keyed penal filler-bubbler spout with concealed vacuum breaker, ball valves on each water connection, multihole fast draining lavatory strainer, 1-1/2" lav drain extension with 17 ga. cast brass removable P-trap located in chase, water closet overflow prevention control, 4" no-hub water closet waste connection, 4" cleanout with stainless steel 3 or 4 prong hook and cable attached to cleanout cover, flanged double welded recessed toilet paper holder, surface mounted towel hook on each side and wall sleeve.

Electronic Controls: Low voltage control capable of field adjustable valve timing, cycle initiation, cycle interval, valve lockout, valve reset and communication with central controller for remote alarm and valve control adjustments. Provide one central controller for each building containing security fixtures.

Fixture: Bradley 5582.
Fixture Control: Bradley Micro-Touch.
Central Control: Bradley Micro-Touch 3000.

EMERGENCY EYEWASH FOUNTAINS AND SHOWERS

EEW-1 - Wall mounted emergency eyewash with plastic bowl, eye and face wash fittings, 1/2" ball valve with push flag operator, dome strainer and wall bracket.

Fixture: Bradley S19-220FW.
Trap: 1-1/4"x1-1/4" 17 ga. cast brass trap with tubular wall return.
Mixing Valve: Bradley #19-2000SE with surface mounted with white enameled cabinet.
Mixing Valve: Bradley #19-2000RSW with recessed stainless steel cabinet with plexiglass window in door.

EEWS-1 - Floor mounted emergency eyewash and shower with plastic shower head and bowl, brass eyewash fittings, 1" spring return shower valve with pull handle, 1/2" eyewash ball valve with push flag operator, 1-1/4" galvanized steel pipe stand with floor flange.

Fixture: Bradley S19-310.

PART 3 - EXECUTION

INSTALLATION

Install plumbing fixtures according to manufacturer's instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping.

Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

Install barrier free fixtures in compliance with IBC 1108 and 3408, COMM 52, 69 and Federal ADA Accessibility Guidelines. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to 27" above floor to avoid contact by wheelchair users.

Provide unions at water connections to drinking fountains and electric water coolers.

Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.

Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass, same items in concealed locations may be of rough brass finish.

Set floor mounted water closets, floor mounted service sinks; counter mounted lavs and sinks; lav and sink faucets and drains with full setting bed of flexible non-staining plumber's putty. Cover exposed water closet bolts with bolt covers.

Set mop basins to floor and wall with grout or silicone sealant.

Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.

Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust valves for intended water flow rate to fixtures without splashing, noise or overflow. Adjust self-closing lavatory faucets to 15 second cycle. Adjust shower valve temperature limit stops to 110 degree maximum outlet temperature.

Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

Foodservice Equipment: Provide rough-in piping, traps, tailpieces, indirect waste lines and Make final and necessary connections for foodservice equipment. Install faucets, spray units, drains, lever drains, vacuum breakers, solenoid valves, check valves, flow control valves, water inlet fittings, filters, strainers, pressure reducing valves and gas valves

furnished by foodservice equipment contractor. Provide condensate drain piping from cooler and freezer evaporators. Make all final and necessary plumbing connections.

Existing Fixtures: Where existing fixtures and fittings are indicated to be reused or relocated, this contractor is responsible for documenting condition prior to construction and for damages incurred during construction.

END OF SECTION 22 42 00

SECTION 22 70 00 – WELL AND PUMPING EQUIPMENT

PART 1 – GENERAL

SCOPE

Construction of a water supply well in a consolidated formation using rotary or percussion methods.

Furnishing and installation of pumping equipment and controls.

REFERENCES

ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service.

ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

NR 812 - Wisconsin Administrative Code, Well Construction and Pump Installation.

QUALITY CONTROL

Driller shall have a valid Wisconsin well driller's license and be experienced in the type of work specified.

Work shall be done according to NR 812.

During well construction make daily construction reports to the engineer.

SUBMITTALS

Submit Wisconsin Well Constructor's Report to the Department of Natural Resources and to the engineer.

Submit test pumping report to engineer.

Submit water samples to State Laboratory of Hygiene for analysis. Submit laboratory results to engineer.

Submit manufacturer's literature on well pump, pitless adapter, pressure tank and controls.

DRILLING SAMPLES

Drilling samples shall be taken at 5-foot intervals and all changes in formation. Dry and bag the samples and deliver them to the Wisconsin Geological Survey for logging.

WELL DESIGN

The well shall be a 6-inch well approximately 300 feet deep in an unconsolidated formation. The well shall be cased to a minimum depth of 100 feet with solid wall casing. Terminate with a 48 inch long well screen. The well shall be grouted to the depth of the solid wall casing. Pump setting shall be at 225 feet.

PART 2 – PRODUCTS

CASING AND LINER PIPE

New, unused, and nonreclaimed steel pipe meeting requirements of ASTM A53; ASTM A106; ASTM A589, Type I, Grade A or B, Type II, Grade A ; API 5CT; API 5D; or API 5L. Dimensions and weight of the pipe shall meet the requirements of the following table.

Minimum Steel Casing Pipe Weights and Dimensions					
Nominal Size in Inches	Weight in Lbs. per Ft.		Thickness in Inches	Diameter in Inches	
	Threaded & Coupled	Plain End		External	Internal
6	19.45	18.97	.280	6.625	6.065
6-5/8	20.00	19.49	.288	6.625	6.049
7	23.00	22.63	.317	7.000	6.366
8	29.35	28.55	.322	8.625	7.981
10	41.85	40.48	.365	10.750	10.020
12	51.15	49.56	.375	12.750	12.000

Temporary casing may be lighter weight than specified for a given diameter in the above table.

Liner pipe used for sealing off a caving or sloughing zone shall meet the requirements of the above table except that it may have a lesser wall thickness than is required by the table for the diameter of pipe used. Liner pipe shall have a minimum wall thickness of 0.216 inches.

Non-metallic PVC casing will be allowed with prior review and approval by the engineer.

WELL ACCESSORIES

Drive Shoe: Welded or threaded to the bottom of the casing being driven. Couplings may not be used for drive shoes.

Grout Shoe: Constructed of durable nontoxic material that will not impart taste or odor to water.

Drilling Aids: Approved by the Wisconsin Department of Natural Resources.

Pitless adapter: Shop assembled and tested. Approved for use in Wisconsin.

Well Cap: Type approved by Wisconsin Department of Natural Resources.

Drop Pipe

1. PVC: ASTM D1785, Schedule 80, screwed joints.
2. Galvanized Steel: ASTM A53, Schedule 40, screwed joints.

Well Screen: Continuous-slot screen composed of stainless steel, everdur, monel, or brass.

GROUT

Neat Cement Grout: A mixture of one bag of Portland cement (94 lb.) and 5 to 6 gallons of water. Powdered bentonite may be added up to a ratio of 5 pounds per 94-lb. Bag of cement. Additives to increase fluidity, control shrinkage or time of set may be used only with approval.

PUMP AND CONTROLS

Pump

Submersible turbine pump, Goulds or equal.

Power Supply: 230 volt, 3-wire, 60 Hz, single phase.

Pump Characteristics:

Capacity: 40 GPM

Minimum developed static pressure as measured at the pitless adaptor: 50 PSI.

Controls: The control system for this well pump shall be a constant pressure system using a Goulds Aquavar SPD using a single phase power supply, variable speed motor drive with 3-phase output, three phase pump, and pressure transducer to control pressure.

Pressure Tank: The pressure tank shall be an ASME-rated and certified tank with minimum tank volume of 110 gallons and a minimum acceptance of 34 gallons.

Pressure Controls: The pressure transducer and system relief valve shall be located at the pressure tank. All control signal wiring is the responsibility of the Well Contractor.

PART 3 – EXECUTION

PROTECTION OF WATER SUPPLY

Take necessary precautions during the well construction to prevent contaminated water, gasoline, or other contaminants from entering the well through the opening or by seepage through the ground surface.

Store and handle casing pipe in such a manner as to keep the possibility of contamination to a minimum.

Maintain a chlorine residual in the well during the drilling operation.

If the well becomes contaminated or water having undesirable physical or chemical characteristics enters the well because of the Contractor's neglect, the Contractor shall at his expense remove the contamination.

WELL CONSTRUCTION

Perform drilling with either rotary or percussion equipment.

Meet requirements of NR 812.14.

When the drill hole shown on the Drawings is approximately the same size as the casing to be installed, the drill shall not be larger than necessary to permit the installation of the casing.

Temporary casings may be used to assist in the construction. Remove all temporary casing upon completion of the well.

Provide a drive shoe for all driven casing.

The upper drill hole may be made larger to allow installation of the casing without driving. If this method is used, the annular space between the casing and the wall of the drill hole shall be grouted.

All suspended casings and liners shall have a packer attached to the bottom and spacers shall be used to ensure a uniform annular space.

All casing and liner pipe joints shall be watertight. Joints may be welded or threaded couplings. Welding shall meet the requirements of AWS D10.12-89.

Any water needed for drilling operations is the responsibility of the Contractor.

WATER QUALITY ANALYSIS

Laboratory Testing: After completion of the test pumping and after disinfection, collect water samples for testing by the State Laboratory of Hygiene or other laboratory approved by the DNR, and transport the samples to the lab. Laboratory analysis shall include: coliform, pH, hardness, iron, manganese and nitrates.

PLUMBNESS AND ALIGNMENT

Plumbness: The deviation per 100 feet of well depth from plumb of the centerline of the well shall not exceed 75 percent of the well diameter.

Alignment: The well shall allow free passage of the pump to be permanently installed in the well to the depth of the pump setting plus 25 percent of the depth.

GROUTING

Remove foreign materials from the annular space to be grouted.

Provide a minimum annular space of 1-1/2 inch.

Use neat cement grout

Place grout from the bottom of the open annular space in one continuous operation, completing the placement before the initial set.

Grouting shall be performed by pressure methods.

1. Conductor Pipe - Gravity: Place the grout material into the annular space through a funnel or hopper connected to a conductor pipe. Lower the conductor pipe to the bottom of the annular space. The end of the conductor pipe shall be submerged at all times. If the grouting operation is interrupted, raise the conductor pipe above the grout level. Do not resubmerge the conductor until all air and water have been displaced from the conductor.

2. Conductor Pipe - Pumped: Place the grout material into the annular space by pumping through a conductor pipe. Lower the conductor pipe to the bottom of the annular space. The end of the conductor pipe shall be submerged at all times. If the grouting operation is interrupted, raise the conductor pipe above the grout level. Do not resubmerge the conductor until all air and water have been displaced from the conductor.

3. Grout Shoe: Attach a grout shoe with a check valve to the bottom of the well casing. A conductor pipe or drill stem shall be connected to the grout shoe and shall extend up through the casing to a pump. When the annular space has been filled with grout, remove the conductor pipe or drill stem. After the grout has set for a minimum of 12 hours the grout shoe may be drilled out and the well construction continued.

The grout shall be brought up to the ground surface. The density of the grout flowing from the annular space shall be the same as the density of grout being placed. If the grout settles, the driller shall add grout to bring the level up to the specified level.

WELL DEVELOPMENT

Develop the well until the water is practically clear and free of sand according to NR 812.22.

PUMPING TEST

Perform a yield and drawdown test of the completed well. Provide pumping equipment capable of pumping within a range of 5 GPM to 50 GPM

Provide all of the necessary equipment and piping to accurately measure the pumping rate and the water level.

Unless the time is extended by the engineer, the pump test shall continue for four hours. Pumping rates and corresponding water levels shall be recorded at intervals of not more than 30 minutes

Keep a log of the test pumping and submit the log to the engineer at the end of the test. The log shall include the following information:

1. Pump setting
2. Static water level
3. Pumping rate and water level at specified intervals
4. Recovery water levels
5. Water level in test well
6. Amount of sand being pumped
7. Other pertinent data

DISINFECTION

Following completion of the construction, thoroughly disinfect the well according to NR 812.22 (4).

SITE PROTECTION AND CLEANUP

Protect structures, turf, landscaping, and site structures from damage.

Discharge water pumped from the well in a manner that does not damage property or cause a nuisance.

Remove all debris and unused materials from the site, remove mud pits, and generally leave the site in a neat condition.

CAPPING

Provide a temporary cap during construction.

PUMP INSTALLATION

Provide pump with characteristics based on the test pumping.

Final pump setting will be established by the engineer.

Provide pitless adapter and permanent well cap.

END OF SECTION 22 70 00

SECTION 22 70 01 – INTERIOR OIL INTERCEPTORS AND ACCESSORIES

PART 1 – GENERAL

SCOPE

RELATED WORK

Section 22 13 00 - Facility Sanitary Sewerage

REFERENCE

Applicable provisions of Division 1 govern work under this section.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Contractor shall submit manufacturer's standard literature on the proposed product showing dimensions of unit, materials of construction, exact locations of inlet and outlet, vent tapplings, weight of unit, and unit flow and storage capacities.

Provide specific information for unit proposed for this project, including exact covers proposed, exact riser rings, ballasting requirements, etc.

PRODUCT APPROVAL

Proposed approval shall be previously approved by the State of Wisconsin and certification of such approval shall be submitted as part of the Shop Drawing process.

PART 2 – PRODUCTS

OIL SEPARATEOR (OS-1)

Based on Schier Model OS-75.

Steel products of similar performance by J.R. Smith, Rockford, or Wade will be acceptable.

Pre-cast concrete products meeting the State of Wisconsin requirements will also be acceptable.

Base project shall be a sand/oil separator constructed of high density polyethylene suitable for below grade installation, with adjustable riser system, built-in flow control, integral vent connections.

Unit nominal capacities and dimensions shall be as follow:

4" inlet connection suitable for PVC pipe.

4" outlet connection suitable for PVC pipe.

Maximum flow rate of 75 GPM

Minimum liquid holding capacity of 125 gallons

Maximum oil storage capacity of 80 gallons
Maximum sand holding capacity of 19 gallons
Fluid operating temperatures ranging from 32-150 degrees.

Substitute products using external flow control means will be acceptable.

Man-hole cover shall be suitable for pedestrian traffic only and rated 2,000 lb. total loading capacity.

PART 3 – EXECUTION

Plumbing Contractor shall perform final excavation for placement of oil interceptor. Excavate 6 inch greater in depth and base of unit and level as best possible. Do not over-excavate if located on virgin materials. If site is located on fill or accidentally over-excavated, back fill with sand compacting in 3 inch lifts. Demonstrate suitable base to Project Representative before proceeding with additional installation.

The Plumbing Contractor shall provide and install a gravel base for the interceptor with a minim thickness of 3 inches. Gravel shall be natural river rock or a similarly natural and hard product. Crushed limestone or sandstone will NOT be acceptable. Level this base and confirm proper elevation for a solid and uniform bearing capacity.

Set interceptor in place ensuring proper slope of drain lines into and out of interceptor.

Backfill around interceptor taking care to ensure unit does not move. Excavated materials may be used for majority of backfill if clean and free of debris and rocks larger than 1.5 inches in nominal diameter. Compact in 6 inch lifts.

No ballasting is anticipated for this project site. Should the excavation yield high ground water, request direction from the Project Representative.

Once backfill reaches top of the interceptor, adjust the riser for finished floor elevations. Backfill around the riser with gravel or crushed rock. Remaining area of backfill may be excavated materials. Compact in 3 inch lifts. At 12 inches below finished grade, obtain subbase materials from the General Contractor and place per his direction. Compact as directed for subbase under concrete slabs.

The General Contractor will provide and install all final concrete and floor finishes. Plumbing Contractor shall be available for final height adjustments during concrete pours.

Piping connections shall be made during backfill procedures. Make solid connections to interceptor, including inlet piping, outlet piping, and vent piping. Solvent weld joints directly to PVC are recommended. Fully support piping over excavation when installing piping. Confirm pipes have adequate slope.

At completion of the project, the interior of the oil interceptor shall be thoroughly cleaned by the Plumbing Contractor. Construction debris, sand, rock and similar materials shall be removed and disposed of. Construction fluids (excluding normal waste water) shall be removed and disposed of, including hydraulic fluids, concrete curing compounds, etc.

The Plumbing Contactor shall demonstrate to the Owner the correct procedures for inspecting the interceptor and for periodic oil extraction. Deliver to Owner any spare materials.

END OF SECTION 22 70 01

SECTION 22 70 02 – EXTERIOR HOLDING TANKS AND ACCESSORIES

PART 1 – GENERAL

SCOPE

RELATED WORK

Section 22 13 00 - Facility Sanitary Sewerage

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM C913 Standard Specification for Precast Concrete Water and Wastewater Structures

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Contractor shall submit manufacturer's standard literature on the proposed product showing dimensions of unit, materials of construction, exact locations of inlet and vent tapings, weight of unit, and unit flow and storage capacities.

Provide specific information for unit proposed for this project, including exact covers proposed, exact riser rings, ballasting requirements, etc.

PRODUCT APPROVAL

Proposed approval shall be previously approved by the State of Wisconsin and certification of such approval shall be submitted as part of the Shop Drawing process.

PART 2 – PRODUCTS

EXTERIOR HOLDING TANK FOR GREASY AND OIL WASTES

This vessel shall be provided to collect all sanitary waste from the vehicle inspection bays.

Based on Crest Precast Model 5000R

Similar products by other manufacturers and fabricators will be acceptable. Only pre-cast concrete vessels will be acceptable. Steel, fiberglass, or polyethylene materials will not be acceptable.

Field-formed concrete vessels will not be acceptable.

Unit nominal capacities and dimensions shall be as follow:

Tank shall have a minimum storage capacity of 5,000 gallons. Tanks of larger capacity will be acceptable.

4" inlet connection suitable for PVC pipe.

Include a minimum of 2 manholes with precast concrete risers and air-tight, cast iron covers.

Tank is recommended to be rectangular in shape with approximate dimensions of 230 inches long x 100 inches wide by 88 inches high.

Man-hole cover shall be suitable for pedestrian traffic only and rated 2,000 lb. total loading capacity. Manhole rings and covers shall be ductile iron, air-tight with gaskets, and permanently labeled with safety access warnings in full compliance with Wisconsin Plumbing Code.

HIGH LEVEL ALARM

The Plumbing Contractor shall provide and install an alarm panel to signal a high water level in the holding tank.

Recommended product is a SJE Rhombus "Tank Alert XT" with:

120 VAC power supply.

NEMA Type 3R enclosure

Red-colored beacon mounted on the unit enclosure. Beacon cannot be turned off in an alarm condition.

Alarm horn with "Test/Silence" switch mounted on cover of unit.

Nema 5-15P cord and plug for power supply to unit.

Separate float switch with 15 feet of water-tight cable hermetically sealed to the float.

PART 3 – EXECUTION

Plumbing Contractor shall perform final excavation for placement of holding tank. Excavate 6 inch greater in depth than base of unit and level as best possible. Do not over-excavate if located on virgin materials. If site is located on fill or accidentally over-excavated, back fill with sand compacting in 3 inch lifts. Demonstrate suitable base to Project Representative before proceeding with additional installation.

The Plumbing Contractor shall provide and install a gravel base for the vessel with a minim thickness of 6 inches. Gravel shall be natural river rock or a similarly natural and hard product. Crushed limestone or sandstone will NOT be acceptable. Level this base and confirm proper elevation for a solid and uniform bearing capacity.

Set vessel in place ensuring proper slope of drain lines into vessel.

Backfill around vessel taking care to ensure unit does not move. Excavated materials may be used for majority of backfill if clean and free of debris and rocks larger than 1.5 inches in nominal diameter. Compact in 6 inch lifts.

No ballasting is anticipated for this project site. Should the excavation yield high ground water, request direction from the Project Representative.

Once backfill reaches top of the vessel, place suitable quantity and size of risers such that the manholes will be located 18 inches above finished grade. Mortar or glue risers to vessel and to one another. Glue manhole ring to top riser.

Provide and install vent into top of holding tank. Vent may be routed straight up to free air. Terminate a minimum of 24 inches above final grade and install a vented cover to discourage entrance of foreign materials or bird nests in the pipe. (A fabricated PVC gooseneck with a screened elbow will be acceptable.)

Backfill the final 12 inches with black dirt suitable for organic growth.

At completion of the project, the interior of the holding tank shall be thoroughly cleaned by the Plumbing Contractor. Construction debris, sand, rock and similar materials shall be removed and disposed of. Construction fluids (excluding normal waste water) shall be removed and disposed of, including hydraulic fluids, concrete curing compounds, etc.

The Plumbing Contractor shall demonstrate to the Owner the correct procedures for inspecting the holding tank. Deliver to Owner any spare materials.

HIGH LEVEL ALARM

The Plumbing Contractor shall install the alarm panel in the building, shall install the float in the holding tank, and shall be responsible for all conduit and wiring between the holding tank and the control panel.

Mount the control panel in the Inspection Bay near an electrical receptacle along the exterior wall. Verify preferred location of the control panel with the Project Representative. Panel shall be located approximately 60 inches above finished floor.

The float shall be installed in the tank near a manhole for easy visual inspection from the manhole. Install a rigid post, secured to the bottom and top of the holding tank, to secure the float. Secure the float to the post such that an alarm condition will occur when the tank is approximately 3/4 full. Post shall be constructed of a corrosion-resistant material of sufficient stiffness. 1 inch diameter stainless steel pipe is recommended.

The float cord shall be routed to a junction box located on a manhole riser, or a self-supporting conduit stub.

Route electrical conductors to the control panel in Schedule 40 PVC conduit. Conduit shall be minimum of 1 inch in size. Conduit shall be buried a minimum of 24 inches below finished grade with a red-colored warning tape installed 12 inches below finished grade.

Provide and install water-resistant conductors and make all final connections at the float and the control panel. (2) -#12 conductors with RHW insulation are recommended for the control signal with a separate #12 grounding conductors. Make all wiring connections exterior to the building in a water-proof manner.

The Plumbing Contractor shall confirm the float works by manually lifting the float to simulate a high level condition and observing the alarm sounds, the horn can be silenced, and the beacon continues to illuminate until the float is returned to the normal position.

END OF SECTION 22 70 02

SECTION 22 70 03 – PRIVATE ON SITE WASTE TREATMENT SYSTEMS (POWTS) AND EQUIPMENT

PART 1 – GENERAL

SCOPE

RELATED WORK

Section 22 13 00 - Facility Sanitary Sewerage

Section 22 05 23 - General-Duty Valves for Plumbing Piping

REFERENCE

Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

REFERENCE STANDARDS

ASTM C913 Standard Specification for Precast Concrete Water and Wastewater Structures

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Contractor shall submit manufacturer's standard literature on the proposed product showing dimensions of unit, materials of construction, exact locations of inlet and vent tapplings, weight of unit, and unit flow and storage capacities.

Provide specific information for unit proposed for this project, including exact covers proposed, exact riser rings, ballasting requirements, etc.

Include data concerning dimensions, capacities, materials of construction, ratings, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification. Pump curves shall identify design point of operation.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

Pump sizes, capacities, pressures and operating characteristics shall be as scheduled.

Pumps shall meet or exceed operating efficiencies scheduled.

PART 2 – PRODUCTS

SEPTIC TANK WITH INTEGRAL PUMP CHAMBER

This vessel shall be a combination septic tank with isolated pump chamber. The pump chamber shall be separated from the septic chamber with a concrete barrier. A single spill opening with filter shall be provided to transfer fluid from the septic chamber to the pump chamber.

Based on Crest Precast Model 1250-750-47

Similar products by other manufacturers and fabricators will be acceptable. Only pre-cast concrete vessels will be acceptable. Steel, fiberglass, or polyethylene materials will not be acceptable.

Field-formed concrete vessels will not be acceptable.

Unit nominal capacities and dimensions shall be as follow:

Septic chamber shall have a minimum capacity of 1,250 gallons.

Pump chamber shall have a minimum capacity of 750 gallons.

4" inlet connection suitable for PVC pipe.

Include a minimum of 3 manholes with precast concrete risers and air-tight, cast iron covers.

Tank is recommended to be rectangular in shape with approximate dimensions of 174 inches long x 78 inches wide by 66 inches high.

Man-hole covers shall be suitable for pedestrian traffic only and rated 2,000 lb. total loading capacity. Manhole rings and covers shall be ductile iron, air-tight with gaskets, and permanently labeled with safety access warnings in full compliance with Wisconsin Plumbing Code.

PUMPS

Pumps shall be fully-assembled sump pumps suitable for effluent duty only, with integral base mounting and support feet to keep pump above the base of the sump.

Refer to the Schedule on the Drawings for pump capacity requirements.

Pumps shall include an integral lifting handle.

Pumps shall be hermetically sealed allowing for infrequent submersion in liquid.

The pump chamber shall be equipped with a duplex set of pumps for primary and standby duty.

PUMP CONTROL PANEL

The Plumbing Contractor shall provide and install a duplex control panel to operate the system dosing pumps and to signal a high level alarm condition.

Recommended product is a SJE Rhombus “RLS” duplex control panel using conventional relay logic, with:

120 VAC power supply.

NEMA Type 4X enclosure suitable for exterior mounting.

Red-colored beacon mounted on the unit enclosure. Beacon cannot be turned off in an alarm condition.

Alarm horn with “Test/Silence” switch mounted on cover of unit.

Floats for primary pump on, secondary pump on, and pumps off.

Separate float switch for alarm condition.

All floats shall be hermitically sealed with a minimum of 15 feet of cord suitable for a hard-wire connection to the control panel.

Each pump shall be fitted with a resettable circuit breaker accessible from inside the panel.

Include an alternating panel to automatic switch operation of the primary pump.

LEECHING CHAMBERS

Leeching chambers shall be constructed of injection-molded high density polyethylene and fabricated to interlock with adjacent chambers in a water-resistant manner.

Leeching chambers supplied for this project shall be approved by the State of Wisconsin for use in a conventional POWTS application.

Leeching chambers shall be formed with an integral arc and constructed with corrugations to provide a structurally stable product. The chambers shall have a load rating no less than H-10 (16,000 lb. per axle with a minimum of 12 inches of soil cover per IAPMO PS 63 test standard.)

Chambers for this project shall be nominally 16” wide providing 6.67 square feet of surface area beneath the chamber for soil absorption.

Chambers shall include a means to suspend a dosing piping from the top of the chambers.

PART 3 – EXECUTION

SEPTIC TANK WITH INTEGRAL PUMP CHAMBER

Plumbing Contractor shall perform final excavation for placement of septic tank. Excavate 6 inch greater in depth than base of unit and level as best possible. Do not over-excavate if located on virgin materials. If site is located on fill or accidentally over-excavated, back fill

with sand compacting in 3 inch lifts. Demonstrate suitable base to Project Representative before proceeding with additional installation.

The Plumbing Contractor shall provide and install a gravel base for the vessel with a minimum thickness of 6 inches. Gravel shall be natural river rock or a similarly natural and hard product. Crushed limestone or sandstone will NOT be acceptable. Level this base and confirm proper elevation for a solid and uniform bearing capacity.

Set vessel in place ensuring proper slope of drain lines into vessel.

Backfill around vessel taking care to ensure unit does not move. Excavated materials may be used for majority of backfill if clean and free of debris and rocks larger than 1.5 inches in nominal diameter. Compact in 6 inch lifts.

No ballasting is anticipated for this project site. Should the excavation yield high ground water, request direction from the Project Representative.

Once backfill reaches top of the vessel, place suitable quantity and size of risers such that the manholes will be located 18 inches above finished grade. Mortar or glue risers to vessel and to one another. Glue manhole ring to top riser.

Provide and install vent into top of septic chamber. Vent may be routed straight up to free air. Terminate a minimum of 24 inches above final grade and install a vented cover to discourage entrance of foreign materials or bird nests in the pipe. (A fabricated PVC gooseneck with a screened elbow will be acceptable.)

Backfill the final 12 inches with black dirt suitable for organic growth.

At completion of the project, the interior of the tank shall be thoroughly cleaned by the Plumbing Contractor. Construction debris, sand, rock and similar materials shall be removed and disposed of. Construction fluids (excluding normal waste water) shall be removed and disposed of, including hydraulic fluids, concrete curing compounds, etc.

The Plumbing Contractor shall demonstrate to the Owner the correct procedures for inspecting the tank and for servicing and replacement of the pump chamber filter. Deliver to Owner any spare materials.

PUMP CONTROL PANEL

The Plumbing Contractor shall install the control panel on a pedestal as shown on the Drawings. The pedestal shall be mounted to the side of the manhole above the pump chamber. Make a penetration through the concrete risers and seal air and water tight as shown on the Drawings.

Mount the control panel on the pedestal. Route cords from the floats through the conduit and the pedestal cavity. The Electrical Contractor will extend line voltage power from the

building to the Control Panel and will make a final connection. The floats shall be installed and wired by the Plumbing Contractor.

The floats shall be installed in the tank near the pump chamber manhole for easy visual inspection from the manhole. Install a rigid post, secured to the bottom and top of the holding tank, to secure the floats. Secure the floats to the post and adjust each float for proper level control. Post shall be constructed of a corrosion-resistant material of sufficient stiffness. 1 inch diameter stainless steel pipe is recommended.

The Plumbing Contractor shall confirm that all floats works by manually lifting the floats to simulate:

Pump #1 on
Pump #2 on
High level alarm
Pumps off.

Do not run pumps dry. Test operation of the control panel with final connections to the pump left un-terminated.

LEECHING CHAMBERS AND SEPTIC FIELD

The soil conditions allow for a conventional septic field using dosing rather than gravity flow. Provide and install dozing piping within the leeching chambers with holes as noted and/or scheduled.

Excavate the septic field to be perfectly level and smooth field.

Set leeching chambers as shown on the drawings and interlock to prevent top soil erosion into the septic field.

Provide and install dozing piping in the leeching chambers and secure as shown.

Extend pumped effluent discharge from the pumps to the center of the septic field. Make connections to the dosing piping and balance flows for even distribution.

Backfill carefully and uniformly. Backfill may be done with excavated materials if relatively clean and free of rocks and debris. Last 8 inches of backfill shall be with black dirt suitable for organic growth (grass).

END OF SECTION 22 70 03

END OF DIVISION 22 - PLUMBING

43. SWEF Building, Heating and Ventilating, Item SPV.0105.103.

A Description

This item consists of the HVAC work for the SWEF building. The work shall be according to the applicable plans and the following specifications.

B (Vacant)

C (Vacant)

D Method of Measurement

The department will measure SWEF Building, Heating and Ventilating, completed in accordance to the contract and accepted, as a single complete unit of work.

E Basis of Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.103	SWEF Building, Heating and Ventilation	LS

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

DIVISION 23 – HVAC

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SECTION 23 05 00 – COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL

SCOPE

This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

RELATED WORK

Section 23 05 13 – Common Motor Requirements for HVAC.

Section 23 33 00 – Air Duct Accessories.

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

Abbreviations of standards organizations referenced in other sections are as follows:

AABC	Associated Air Balance Council
ABMA	American Boiler Manufacturers Association
ADC	Air Diffusion Council
AGA	American Gas Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
CGA	Compressed Gas Association
CTI	Cooling Tower Institute
EPA	Environmental Protection Agency
GAMA	Gas Appliance Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
MCA	Mechanical Contractors Association
MICA	Midwest Insulation Contractors Association

MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
UL	Underwriters Laboratories Inc.
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
UL1479	Fire Tests of Through-Penetration Firestops
UL723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE

Refer to Division 1, General Conditions, Equals and Substitutions.

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 for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

PROTECTION OF FINISHED SURFACES

Refer to Division 1, General Requirements, Protection of Finished Surfaces.

Furnish one can of touch-up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

SLEEVES AND OPENINGS

Refer to Division 1, General Requirements, Sleeves and Openings.

SEALING AND FIRESTOPPING

Sealing and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

SUBMITTALS

Refer to Division 1, General Conditions, Submittals.

Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.

Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule are in agreement or indicate any discrepancies. See related comments in Section 23 05 13 in Part 1 under Electrical Coordination.

Include wiring diagrams of electrically powered equipment.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

- Records of tests performed to certify compliance with system requirements
- Certificates of inspection by regulatory agencies
- Valve schedules
- Lubrication instructions, including list/frequency of lubrication

OFF SITE STORAGE

Generally, ductwork, metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for off site storage. For material that can be stored off site, no material will be accepted for off site storage unless shop drawings for that material have been approved.

CERTIFICATES AND INSPECTIONS

Refer also to Division 1 General Conditions, Permits, Regulations, Utilities and Taxes.

Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer according to Wis Adm Code Section ILHR 50.12. Deliver originals of these certificates to the Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

OPERATING AND MAINTENANCE INSTRUCTIONS

Refer to Division 1, General Requirements, Operating and Maintenance Instructions.

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 approved shop drawings.
- Manufacturer's wiring diagrams for electrically powered equipment
- Records of tests performed to certify compliance with system requirements
- Certificates of inspection by regulatory agencies.
- Temperature control record drawings and control sequences
- Parts lists for manufactured equipment..
- Valve schedules
- Lubrication instructions, including list/frequency of lubrication done during construction
- Warranties
- Additional information as indicated in the technical specification sections

TRAINING OF OWNER PERSONNEL

Instruct user agency personnel in the proper operation and maintenance of systems and equipment provided as part of this project; video tape all training sessions. Include not less than 16 hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

RECORD DRAWINGS

Refer to Division 1, General Requirements, Record Drawings.

In addition to the data indicated in the General Requirements, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

PART 2 – PRODUCTS

ACCESS PANELS AND DOORS

LAY-IN CEILINGS:

Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are sufficient; no additional access provisions are required unless specifically indicated.

CONCEALED SPLINE CEILINGS:

Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Section 09500.

METAL PAN CEILINGS:

Removable sections of ceiling tile held in position by a pressure fit will be provided under Section 09500.

PLASTER WALLS AND CEILINGS:

16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas,

concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

IDENTIFICATION

STENCILS:

Not less than 1 inch high letters/numbers for marking pipe and equipment.

SNAP-ON PIPE MARKERS:

Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for piping marking. W. H. Brady, Seton, Marking Services, or equal.

ENGRAVED NAME PLATES:

White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.

VALVE TAGS:

Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company, Marking Services, or W. H. Brady.

SEALING AND FIRESTOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Manufacturers:

3M, Hilti, Rectorseal, STI/SpecSeal, Tremco, or approved equal.

All firestopping systems shall be provided by the same manufacturer.

Submittals:

Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

Product:

Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.

Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

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. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

Duct Penetrations:

Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.

Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 – EXECUTION

EXCAVATION AND BACKFILL

Perform all excavation and backfill work to accomplish indicated mechanical systems installation according to Division 31 - Earthwork. Blasting will not be allowed without written permission of the Architect/Engineer and the user agency.

Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and ensure there is no disturbance of bearing soil.

CONCRETE WORK

All cast-in-place concrete will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support of mechanical equipment.

CUTTING AND PATCHING

Refer to Division 1, General Requirements, Cutting and Patching.

BUILDING ACCESS

Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

EQUIPMENT ACCESS

Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.

Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

COORDINATION

Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units installed in/on architectural surfaces.

Coordinate all work with other contractors 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.

Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify system completion to the test and balance agency (flushing, pressure testing, chemical treatment, filling of liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

IDENTIFICATION

Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background for stenciling, or provide snap-on pipe markers as specified in Part 2 – Products.

Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear plastic.

Use engraved name plates to identify control equipment.

Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, “SMOKE DAMPER” or “FIRE DAMPER”. Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

LUBRICATION

Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication according to the manufacturer's instructions until the work is accepted by DFD. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

SLEEVES

PIPE SLEEVES:

Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall.

Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.

Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.

Extend the top of sleeve 1 inch above the adjacent floor in piping floor penetrations located in the mechanical rooms and wet locations listed below. In finished areas sleeves shall be flush with rough floor.

For floor pipe penetrations through existing floors in mechanical rooms and wet locations listed below, core drill opening and provide 1-1/2" x 1-1/2" x 1/8" galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from getting to penetration. Provide urethane caulk between angles and floor and fasten angles to floor minimum 8" on center. Seal corners water tight with urethane caulk. Or, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to existing floor structure

For pipe penetrations through existing floors located in food service areas, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. Size sleeve to allow insulated pipe to run through sleeve and paint the sleeve.

Pipe sleeves are not required in cored floor pipe penetrations through existing floors that are not located in mechanical rooms, food service areas or wet locations listed above.

DUCT SLEEVES:

Duct sleeves are not required in non-rated partitions or floors.

Provide sleeve required for fire dampers in fire-rated partitions and floors. Reference fire damper details on drawings.

For duct penetrations through mechanical room floors and wet locations listed below, provide 1-1/2" x 1-1/2" x 1/8" galvanized steel angles fastened to floor around the perimeter of the duct opening to prevent water from getting to floor opening. Provide urethane caulk between angles and floor and fasten angles to floor 8" on center. Seal corners water tight with urethane caulk.

Wet locations include:

- Parking ramps
- Sanitary pumping stations
- Swimming pool equipment rooms
- Chemical storage and hazardous waste storage rooms
- Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.)

SEALING AND FIRESTOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Install approved product according to the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.

Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

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 penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include laboratories, clean rooms, animal rooms, kitchens, cart wash rooms, janitor closets, cart wash rooms, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, and where noted on drawings elsewhere.

END OF SECTION 23 05 00

SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 – GENERAL

SCOPE

This section includes requirements for single phase motors that are used with equipment specified in other sections.

RELATED WORK

Division 26 00 00 - Electrical

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators

ANSI/NEMA MG-1 Motors and Generators

ANSI/NFPA 70 National Electrical Code

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Include with the equipment which the motor drives the following motor information: motor manufacturer, horsepower, voltage, phase, hertz, rpm, full load efficiency. Include project wiring diagrams prepared by the contractor specifically for this work.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

Lubrication instructions, including list/frequency of lubrication

Table noting full load power factor, service factor, NEMA design designation, insulation class and frame type for each motor provided

ELECTRICAL COORDINATION

All starters, overload relay heater coils, disconnect switches and fuses, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are furnished and installed by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices

are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor. See related comments in Section 23 05 00 - Common Work Results for HVAC, under Shop Drawings.

Electrical Contractor will provide all power wiring and control wiring, except temperature control wiring.

Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

PRODUCT CRITERIA

Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

Furnish motors for starting according to utility requirements and compatible with starters as specified.

PART 2 – PRODUCTS

SINGLE PHASE, SINGLE SPEED MOTORS

Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller.

Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

TWO-SPEED MOTORS

Unless otherwise indicated, three phase two speed motors to be [one winding, consequent pole, variable torque type] [two winding, variable torque] and single phase motors to be capacitor start capacitor run type having two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

MOTORS USED ON VARIABLE FREQUENCY DRIVES

In addition to the requirements specified above, the motor must be suitable for use with the drive specified in Section 23 05 14, including but not limited to motor cooling. Motor shall comply with NEMA MG1 Part 31 to provide windings capable to withstand up to 1600 peak Volts with a rise time of 0.1 μ s. Provide bearing protection grounding rings to bleed

current from the motor shaft to the motor casing. Manufacturers: Aegis SGR, Inpro/Seal CDR, or equal.

PART 3 – EXECUTION

INSTALLATION

Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.

When motor will be flexible coupled to the driven device, mount coupling to the shafts according to the coupling manufacturer's recommendations. Using a dial indicator, check angular misalignment of the two shafts; adjust motor position as necessary so that the angular misalignment of the shafts does not exceed 0.002 inches per inch diameter of the coupling hub. Again using the dial indicator, check the shaft for run-out to assure concentricity of the shafts; adjust as necessary so that run-out does not exceed 0.002 inch.

When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts according to the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is according to the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

Verify the proper rotation of each three-phase motor as it is being wired or before the motor is energized for any reason.

Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use. Include this information in the maintenance manuals.

END OF SECTION 23 05 13

SECTION 23 05 15 – PIPING SPECIALTIES

PART 1 – GENERAL

SCOPE

This section contains specifications for HVAC piping specialties for all piping systems.

RELATED WORK

Section 23 11 00 - Facility Fuel Piping

Section 23 05 23 - General-Duty Valves for HVAC Piping

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

Section 23 07 00 - HVAC Insulation

Section 23 21 13 - Hydronic Piping

REFERENCE

Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Required for all items in this section. Include materials of construction, dimensional data, ratings/capacities/ranges, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

All piping specialties are to be rated for the highest pressures and temperatures in the respective system according to ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

PART 2 – PRODUCTS

THERMOMETERS

Manufacturers: Ashcroft, Marsh, Taylor, H. O. Trerice, U. S. Gauge, Weiss, Weksler.

Stem Type, cast aluminum case, nine inch scale, clear acrylic window. adjustable angle brass stem with stem of sufficient length so the end of the stem is near the middle of a pipe

without reducing the thickness of any insulation, red indicating fluid, black lettering against a white background, with scale ranges as follows:

<u>Service</u>	<u>Scale Range, °F</u>	<u>Min. Increment, °F</u>
Hot Water	30 – 240	2
Chilled Water	0 – 100	1
Glycol Water	30-130	2
Condenser Water	0 - 120	1
	or 30 – 130	1

THERMOMETER SOCKETS

Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

TEST WELLS

Similar to thermometer sockets except with a brass cap that thread into the inside of the test well to prevent dirt from accumulating. Secure cap to body with a short chain. Furnish with extension necks, where appropriate, to accommodate the pipeline insulation.

P/T (PRESSURE/TEMPERATURE) TEST PLUGS

Brass plug with 1/4" NPT threads, EPDM or neoprene valve core, knurled cap with cap strap. Use extended length plugs to clear insulated piping. Adaptors shall have 1/4" FPT connection for standard pressure gauges.

HOSE CONNECTON CAPS

Hose connection caps shall be pressure rated for 150 psig at 180 deg F.

PRESSURE GAUGES

Manufacturers: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale, with scale range as follows:

<u>Service</u>	<u>Scale Range, psig</u>	<u>Min. Increment, psig</u>
Hot Water		
Chilled Water		
Glycol Water		

PRESSURE SNUBBERS:

Bronze construction, suitable for system working pressure, 1/4" size.

GAUGE VALVES:

Use valves as specified in Section 23 05 23 - General-Duty Valves for HVAC Piping. For water systems, use 1/4" ball valves. For steam systems, use 1/4" gate valves suitable for system working pressure.

STRAINERS

Manufacturers: Armstrong, Hoffman, Illinois, Keckley, Metraflex, Mueller Steam, or Sarco.

WATER SYSTEMS:

Y type; cast iron body; stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded body in sizes through 2 inch and rated at not less than 175 psi WOG; flanged body in sizes over 2 inch and rated at not less than 125 psi WOG at 240°F. Screen to be 20 mesh for line sizes 2 inch and less, 0.125 inch perforations for line sizes 2-1/2 inch through 4 inch, and 0.25 inch perforations for line sizes 5 inch and larger.

Basket type: Cast iron body with clamped cover; stainless steel screens; body tapped for a blowoff valve; 125 psig flanged body for 2 1/2" and larger; 0.125 inch perforations for line sizes 2-1/2 inch through 4 inch, and 0.25 inch perforations for line sizes 5 inch and larger.

CENTRIFUGAL SEPARATORS Centrifugal vortex type separator constructed of carbon steel and furnished with flanged inlet and outlet, collection chamber that is openable for inspection or cleaning, flanged separator section to allow interior inspection or cleaning, flanged collection chamber outlet for removing collected material, a relief line from the venturi chamber to the collection chamber to improve solids collection, 1/2 inch gauge connections in the main inlet and outlet connections, and suitable for an operating pressure of not less than 125 psig. Assembly to be capable of removing 98% by weight of all particles 75 microns or larger and having a specific gravity of at least 1.8.

Furnish with a purge assembly consisting of a motorized ball valve and a controller suitable for 120 volt operation and mounting independently near the valve. Ball valve to be suitable for 125 psig operation at 100°F. Controller to allow setting of purge time between 15 seconds and 30 minutes with frequencies between one minute and 16 hours. Include controls to allow automatic operation, manual operation, or de-energizing the controller.

EXPANSION TANKS

Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, Taco, Wessels.

BLADDER TYPE:

Steel construction, tested and stamped according to Section 8D of the ANSI/ASME Code and furnished with the National Board Form U-1, rated for not less than 125 psig working pressure, precharged with air to the initial fill pressure indicated on the drawings, butyl replaceable bladder suitable for fluid temperatures to 220°F, and furnished with a tank drain connection, system connection, mounting saddles for horizontal installation or base for vertical installation, prime coated, size/capacity as indicated on the drawings. Tank and bladder construction must allow field replacement of the bladder on its failure.

AIR SEPARATORS

Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, Taco.

1-1/2 inch and smaller: Cast iron construction, suitable for in-line installation, top and bottom connections for use with expansion tanks specified above, rated at not less than 125 psig at 220°F.

2 inch and larger: Welded steel construction, ASME constructed and stamped for a working pressure not less than 125 psig at 220°F, threaded or flanged connections for 2 inch size, flanged or grooved connections if grooved piping is allowed for all sizes over 2 inch, suitable for use with expansion tanks specified above, drain connection at the bottom of unit, vent/tank connection at the top of unit, suitable for the system flow rates as indicated on the drawings.

Include a galvanized or stainless steel strainer with provisions in the unit shell for strainer removal. Provide a blowdown connection located so that the inside surface of the strainer can be cleaned by draining the system fluid through the blowdown connection.

AIR VENTS**MANUAL KEY TYPE VENTS:**

Bell and Gossett Model 4V; Eaton/Dole Model 9, 9B, or 14A.

Bronze body with nonferrous internal parts, screwdriver operated, designed to relieve air from the system when vent is opened, rated at not less than 125 psig at 220°F.

MANUAL BALL VALVE VENTS:

Provide 1/4" ball valves for manual venting of air handling unit coils and where indicated elsewhere on drawings and details. Reference specifications section 23 05 23.

AUTOMATIC VENTS:

Thrush Model 720, Bell and Gossett Model 107, Watson McDaniel Model AV813W

Cast iron body with nonferrous internal parts, designed to vent air automatically with float principle without allowing air to enter the system, rated at not less than 125 psig at 220°F.

SUCTION DIFFUSERS

Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, Taco.

	<u>Amtrol</u>	<u>Armstrong</u>	<u>B&G</u>	<u>Taco</u>
Body	CI/steel	CI	CI	CI
Straightening		c:CI/steel	steel	CI
Vanes		o:SS/CI		
Strainer	Galv Steel	SS	c:Steel o:SS	SS
Startup Strainer		Brass	c:Bronze o:None	Bronze
Max. psi	175	175	175	175
Max deg. F	250	300	250	250

"c" indicates manufacturer's standard construction for closed systems; "o" indicates manufacturers standard construction for open systems, Jul 89

Verify working pressure requirements when suction diffusers are used on systems connected to existing central chilled and/or hot water plants.

Designed to replace the suction line strainer and the long entrance pipe at a pump suction; constructed with a strainer blowdown connection, provisions for a field supplied support foot, and bolted flange for strainer removal and cleaning; rated at not less than 125 psi working pressure at not less than 250°F.

CLOSED SYSTEMS:

Body constructed of cast iron, ductile iron or carbon steel; cast iron or steel straightening vanes; steel, galvanized steel or stainless steel strainer; brass or bronze fine mesh startup strainer, strainer blowdown connection, inlet pressure gauge connection, provisions for a field supplied support foot, and bolted flange for strainer removal and cleaning; rated at not less than 125 psi working pressure at not less than 250°F.

OPEN SYSTEMS:

Body constructed of cast iron, ductile iron or carbon steel; cast iron, steel or stainless steel straightening vanes; galvanized steel or stainless steel strainer; strainer blowdown connection, inlet pressure gauge connection, provisions for a field supplied support foot, and bolted flange for strainer removal and cleaning; rated at not less than 125 psi working pressure at not less than 250°F.

COLD WATER METERS

Bronze body, minimum 3/4" NPT ends, positive displacement disc type meter with built-in strainer, magnetic drive and thermoplastic disc/register gearing. Meters shall meet ANSI/AWWA Standard C700. Sealed register shall be odometer type totalization display having 10,000,000 gallon capacity. Register shall also have 360 degree sweep hand with 10 gallon range and 0.1 per gallon increments. Meters shall be suitable for 150 psig pressure at 80 degrees F. Badger Recordall Disc Meter, Carlon Meter Co., Neptune, Hersey, Venture Measurement Niagara.

PART 3 – EXECUTION

THERMOMETERS

STEM TYPE:

Install in piping systems as indicated on the drawings and/or details using a separable socket in each location.

DIAL TYPE FOR AIR TEMPERATURE MEASUREMENT:

Install in ductwork where detailed or specified. Support capillary inside duct so it measures a uniform sample of air. Mount readout so it is readily visible on a portion of ductwork that is not externally insulated or on a sheet metal angle support secured to a nearby structural element.

THERMOMETER SOCKETS

Install at each point where a thermometer or temperature control sensing element is located in a pipeline.

TEST WELLS

Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for inserting a thermometer at a later date.

P/T (PRESSURE/TEMPERATURE) TEST PLUGS

Install in piping systems as indicated on the drawings and/or details. Do not insulate over test plugs.

PRESSURE GAUGES

Install in locations where indicated on the drawings and/or details, including any gauge piping, with scale range appropriate to the system operating pressures.

PRESSURE SNUBBERS:

Install in gauge piping for all gauges used on water services.

GAUGE VALVES

Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.

STRAINERS

Install all strainers where indicated on the project details, allowing sufficient space for the screens to be removed. Rotate screen retainer where required by the installation so blowdown can remove accumulated dirt from the strainer body.

WATER SYSTEMS:

Install a ball valve for blowdown in the tapped screen retainer; valve to be the same size as the tapping.

WATER FILTERS

Install water filter in a bypass arrangement around system pump where indicated on the drawings. Allow sufficient clearance at the top of the unit for filter removal and replacement. Anchor filter support stand to a housekeeping pad. Install a shutoff valve upstream and downstream of the filter. Install a pressure gauge with gauge valves, piped so the pressure differential across the filter can be read.

Install the 50 micron filters after the piping system has been cleaned and flushed. Install one set of 10 micron filters when the 50 micron filters need replacing. Give the other set of 10 micron filters and the other set of 50 micron filters to the Owner.

CENTRIFUGAL SEPARATORS

Install centrifugal separator in a bypass arrangement around secondary chilled water system pumps where indicated on the drawings. Allow sufficient clearance at the top of the unit for head removal and cleaning. Support stand with angle iron and other structural support members. Install a shutoff valve upstream and downstream of the separator. Install a pressure gauge with gauge valves, piped so the pressure differential across the separator can be read. Install the motorized drain valve in the collection chamber outlet downstream of a manual shutoff valve; extend piping to the adjacent floor drain. Controller will be installed under the temperature control specification section.

EXPANSION TANKS

Install tanks where indicated on the drawings, coordinating concrete base installation with the General Contractor or fabricating steel supports to suit the application. Install all specified tank accessories.

BLADDER TANKS:

Verify proper air charge; recharge as necessary. Install an isolation valve in the piping connecting the tank to the system. In the piping between the tank and the isolation valve, install a pressure gauge and a drain valve with a hose adapter. Install a drain valve with hose adapter in the drain connection of the tank. Make sure that all drains are accessible and a hose can be attached.

AIR SEPARATORS

Mount in hot and/or chilled water lines as indicated on the drawings/details. Install ball valve with hose adapter in bottom blowdown connection.

Open the drain valve and blowdown the strainer after system cleaning and again after 30 days of operation.

AIR VENTS

MANUAL KEY TYPE VENTS:

Install at all high points where air may collect and not be carried by the system fluid. Use a soft Type L copper "pigtail" so the vent can be positioned for venting and collecting any water that might escape.

MANUAL BALL VALVE VENTS:

Install on air handling coils and where indicated elsewhere as shown on drawings and details.

AUTOMATIC VENTS:

Install on the top of air separators on systems using bladder type expansion tanks. Install at other locations as indicated on the drawings or details. All locations to have a ball valve installed upstream of the vent for maintenance purposes.

SUCTION DIFFUSERS

Install at each pump suction connection for end suction pumps where shown. Provide sufficient space for removal of the strainer. Install a capped drain valve in the blowdown connection. Install support below the suction diffuser so the weight of the suction piping does not rest on the pump suction connection.

Install a pressure gauge across the suction diffuser, valved so that a single gauge can be used to read the inlet pressure and the outlet pressure across the strainer. Use gauge valves as specified with the gauges. This gauge can be the same one used to read pressures across the pump. Select gauge range appropriate to the system pressures.

Open the drain valve and blowdown the strainer after system cleaning and again after 30 days of operation. If the unit is furnished with a fine mesh startup strainer, remove this strainer after the system has been flushed and cleaned.

On applications involving open systems, such as but not limited to cooling towers, remove the fine mesh startup strainer prior to pump operation if the suction diffuser includes such a strainer.

WATER METERS

Install water meters on makeup water line to hot water and chilled water systems ahead of water pressure reducing valve.

END OF SECTION 23 05 15

SECTION 23 05 23 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

SCOPE

This section includes valve specifications for all HVAC systems except where indicated under Related Work.

RELATED WORK

Section 23 05 15 - Piping Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS

Refer to division 1, General Conditions, Submittals.

Contractors shall submit a schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

Where valves are specified for individual mechanical services (i.e. hot water heating, steam, etc.) all valves shall be of the same manufacturer unless prior written approval is obtained from DFD.

PART 2 – PRODUCTS

MANUFACTURERS

Anvil, Apollo, Armstrong, Bell & Gossett, Cash-Acme, Dresser Consolidated, Conval, Crane, Anderson Greenwood and Crosby, Danfoss-Flomatic, DeZurik, Durco, Fisher, Grinnell, Griswold, Hammond, Hancock, Hoffman, Jamesbury, Keystone, Kunkle, Leslie, Lunkenheimer/Cincinnati, Metraflex, Milwaukee, Mueller, Newco, Nexus, Nibco, Powell, RP&C, Sarco, Spence, Stockham, Taco, Tasco, Thrush-Amtrol, Vogt, Watts, or approved equal.

WATER SYSTEM VALVES

All water system valves to be rated at not less than 125 psig water working pressure at 240°F unless noted otherwise.

GATE VALVES:

2" and smaller: Use ball valves; gate valves will not be accepted in sizes 2" and smaller.

2-1/2" and larger: Use butterfly valves; gate valves will not be accepted in sizes 2-1/2" and larger.

BALL VALVES:

2" and smaller: Two piece bronze body; threaded or soldered ends, as appropriate to the pipe material; stainless steel or chrome plated brass/bronze ball; conventional port; glass filled teflon seat; threaded packing gland follower; blowout-proof stem; 600 psig WOG.

Valve stems shall allow operators to clear insulation without interference. Provide stem extensions when valve operators interfere with pipe insulation.

Apollo 70-100/200 series, Hammond 8301/8311, Milwaukee BA100/150, Nibco T/S 585-70, Stockham S206/216.

2-1/2" and over: Ball valves will not be accepted in sizes over 2 inch.

BUTTERFLY VALVES:

2" and smaller: Use ball valves; butterfly valves will not be accepted in sizes 2 inch and smaller.

2-1/2" and larger: Cast iron body; stainless steel shaft; Teflon, nylatron, or acetal bearings; EPDM resilient seat. Disk to be bronze, aluminum-bronze, nickel plated ductile iron, cast iron with welded nickel edge, or 316 - stainless steel. Pressure rated to 150 psig. Valve assembly to be bi-directionally bubble tight to 150 psig with no downstream flange/pipe attached. Nylon coated ductile iron discs are not acceptable. Polymid or polyamide coated valves are not acceptable.

Valve stems shall allow operators to clear insulation without interference. Provide stem extensions when valve operators interfere with pipe insulation.

Use threaded lug type valves for installation with class 125/150 flanges.

Centerline series 200, DeZurik BOS-CL, Keystone Fig. 222, Nibco LD2000 (2-1/2"-12")/LD1000 (14" and above), Bray Series 31H, Victaulic 300 series (2-1/2"-12")/709 series (14"-24").

Provide ten-position lever actuators for valves 6" and smaller. Provide worm gear operators for valves 8" and larger.

Where butterfly valves are indicated or specified to be installed at the location of a flow sensing device, provide the butterfly valves with a memory stop.

GLOBE VALVES:

Do not use globe valves for water service, except in temperature control applications.

SWING CHECK VALVES:

2" and smaller: Class 125, bronze body, threaded or soldered ends, regrindable seat, bronze disc, threaded cap, suitable for installation in a horizontal or vertical line with flow upward.

Crane 137/1342, Hammond IB912/IB940, Lunkenheimer 2144/2145, Milwaukee 509/1509, Nibco T-413-B/S-413-B, Powell 578/1825, Stockham B-309/B-319.

2-1/2" and larger: Class 125, cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward.

Crane 373, Hammond IR1124, Lunkenheimer 1790, Milwaukee F2974, Nibco F918, Powell 559, Stockham G-931.

SPRING LOADED CHECK VALVES:

2" and smaller: Class 125, bronze body, threaded, solder or wafer ends, bronze trim, stainless steel spring, teflon seat unless only bronze available.

APCO 300 series, ConBraCo 61 series, Mueller 303BP, Nibco T-480-Y/S-480-Y, Val-Matic 1400 series.

2-1/2" and larger: Class 125, cast iron or semi-steel body, wafer or globe flanged type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required. Valves with ductile iron in contact with the working fluid will not be accepted.

APCO 600 series, Metraflex 900 series, Milwaukee 1800 series, Mueller Steam 101M-AP/105M-AP, Nibco F910 series, Val-Matic 1800 series, Victaulic series 716.

BALANCE VALVES:

2" and smaller: Bronze or copper alloy body with calibrated ball, globe or venturi/valve arrangement, integral pointer and calibrated scale to register degree of valve opening, memory stop, drain tapping, threaded or soldered ends, with or without integral unions, P/T or Shraeder pressure taps with integral check valves and seals, adjustable memory stop, suitable for 200 psig water working pressure at 250°F.

Armstrong CBV, Bell & Gossett Circuit Setter Plus, Griswold Quickset, Nexus Orturi, Nibco 1710 Series, Taco Accu-Flo, Tour & Anderson STAS/STAD, Victaulic series 786/787.

2-1/2" and larger: Use butterfly valves as specified in this section along with a flow sensing device as specified in Section 23 05 15.

DRAIN VALVES:

Use 3/4 inch ball valve with threaded hose adapter except strainer blowdown valves to be the same size as the blowdown connection.

COMBINATION SHUT-OFF, CHECK, AND BALANCE VALVES:

2 inch and larger: Cast or ductile iron body, threaded or flanged or grooved end connections, stainless steel spring, bronze disc with EPDM seat, calibrated memory stop, backseating valve stem, inlet and outlet pressure tappings, capable of being repacked under full line pressure, and suitable for a minimum working pressure of 175 psig at 240°F when used in hot water heating systems.

Armstrong Flo-Trex, Bell & Gossett Triple Duty, Taco Multi-Purpose Valve, Thrush-Amtrol Tri-Flow.

WATER PRESSURE REDUCING VALVES:

Brass or bronze body, diaphragm operated, with an integral anti-syphon check valve, inlet strainer, and adjustable reduced pressure range but pre-set for the scheduled pressure, 125 psig at 225°F.

Bell & Gossett, Cash-Acme, or Watts.

WATER RELIEF VALVES:

Iron or bronze body, direct pressure actuated, teflon seat, stainless steel stem and spring, suitable for 125 psig water working pressure at 240° F and ASME stamped, with Btu capacity and set point as scheduled.

Bell & Gossett, Cash-Acme, Consolidated, Kunkle, Watts.

NATURAL GAS SYSTEMS

SHUT OFF VALVES:

2" and smaller: Ball valve, bronze body, threaded ends, chrome-plated bronze or stainless steel ball, full or conventional port, teflon seat, blowout-proof stem, two-piece construction, suitable for 150 psig working pressure, U.L. listed for use as natural gas shut-off.

GAS PRESSURE REGULATORS:

2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20°F to 150°F.

SPECIALTY VALVES AND VALVE ACCESSORIES

GAUGE VALVES:

Water Service: Use 1/4" ball valves.

STEM EXTENSIONS:

Provide stem extensions when valve operators interfere with pipe insulation.

PART 3 – EXECUTION**GENERAL**

Properly align piping before installation of valves in an upright position; operators installed below the valves will not be accepted.

Install valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

Install all temperature control valves.

Install all valves with the stem in the upright position. Valves may be installed with the stem in the horizontal position only where space limitations do not allow installation in an upright position or where large valves are provided with chain wheel operators. Where valves 2-1/2" and larger are located more than 12'-0" above mechanical room floors, install valve with stem in the horizontal position and provide a chain wheel operator. Valves installed with the stems down, will not be accepted.

Install stem extensions when shipped loose from valve.

Prior to flushing of piping systems, place all valves in the full-open position.

SHUT-OFF VALVES

Install shut-off valves at all equipment, at each branch take-off from mains, and at each automatic valve for isolation or repair.

WATER SYSTEM:

Butterfly valves installed at the location of a flow sensing device are to have a memory stop.

BALANCING VALVES

Provide balancing valves for all major equipment and at each major branch takeoff and at the discharge of each pump as indicated on drawings and details.

CALIBRATED BALANCE VALVES:

Install where indicated on the drawings and details for balancing of hydronic systems. Retain the shipping container for use as removable insulation.

DRAIN VALVES

Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, equipment locations specified or detailed including reheat coils, other locations required for drainage of systems.

SAFETY RELIEF VALVES

Use air pressure to clean piping prior to installation of safety relief valves.

Install relief valves in locations indicated on drawings, downstream of all pressure reducing valves, and on all boilers.

Install valves in the vertical position, with drain holes, including those from dip pan elbows, piped to the nearest drain.

Inlet and outlet piping connecting to valves must be the same size as valve connections or larger.

SPRING LOADED CHECK VALVES

Install a spring loaded check valve in each pump discharge line where two pumps operate in parallel and no combination shutoff, check and balancing valve is being used.

SWING CHECK VALVES

Provide swing check valves where specified, detailed, and at steam condensate lines where they rise at outlet of traps. In such cases, provide isolation valves to allow repair or replacement of check valve.

COMBINATION SHUT-OFF, CHECK, AND BALANCING VALVES

Contractor may use combination shut-off, check and balancing valves where separate shut-off valve, check valve, and balancing valve are specified or detailed in pump discharge piping.

PRESSURE REDUCING VALVES

Provide gate valve and strainer at inlet. Provide gate valve at outlet.

Install pressure gauges to indicate inlet and outlet pressure at each pressure reducing valve according to Section 23 05 15 - Piping Specialties.

Use eccentric reducers at inlet and outlet of reducing valves where connections are not the same size as adjacent piping.

GAS PRESSURE REGULATORS

When the gas pressure regulator is equipped with a vent connection, run a connection size vent to outside air according to codes. Use a larger size vent when required by the manufacturer's installation instructions.

END OF SECTION 23 05 23

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

SCOPE

This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors

RELATED WORK

Section 23 07 00 - HVAC Insulation

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS

MSS SP-58 Materials, Design, Manufacture, Selection, Application, and Installation

QUALITY ASSURANCE

Refer to Division 1, General Conditions, Equals and Substitutions.

DESCRIPTION

Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

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; see Related Work above.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service. Reference section 23 05 00.

DESIGN CRITERIA

Materials and application of pipe hangers and supports shall be according to MSS Standard Practice SP-58 unless noted otherwise.

Piping connected to base mounted pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

Piping flexible connections and vibration isolation supports are required for piping connected to coils that are in a fan assembly where the entire assembly is mounted on vibration supports; the vibration isolation supports are required for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Piping flexible connection and vibration isolation supports are not required when the fan section is separately and independently isolated by means of vibration supports and duct flexible connections. Standard pipe hangers/supports as specified in this section are required when there are no vibration isolation devices in the piping and beyond the 100 pipe diameter/3 support distance.

Piping supported by laying on the bottom chord of joists or trusses will not be accepted.

Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

PART 2 – PRODUCTS

PIPE HANGER AND SUPPORT MANUFACTURERS

Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

STRUCTURAL 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 tanks and equipment.

PIPE HANGERS AND SUPPORTS

HANGERS FOR STEEL PIPE SIZES 1/2" THROUGH 2":

Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

HANGERS FOR STEEL PIPE SIZES 2-1/2" AND OVER:

Carbon steel, adjustable, clevis, black finish. Anvil figure 260.

Adjustable steel yoke, cast iron roll, double hanger. Anvil figure 181.

MULTIPLE OR TRAPEZE HANGERS:

Steel channels with welded spacers and hanger rods if calculations are submitted.

WALL SUPPORT:

Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.

FLOOR SUPPORT FOR PIPE SIZES THROUGH 4”:

Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

COPPER PIPE SUPPORT:

Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.

INSULATION PROTECTION SHIELDS:

Galvanized carbon steel of not less than 18 gauge for use on insulated pipe 2-1/2 inch and larger. Minimum shield length is 12 inches. Equal to Anvil figure 167.

STEEL HANGER RODS:

Threaded both ends, threaded one end, or continuous threaded, black 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.

<u>Maximum Load (Lbs.)</u> <u>(650°F Maximum Temp.)</u>	<u>Rod Diameter</u> <u>(inches)</u>
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

Provide rods complete with adjusting and lock nuts.

WOOD STRUCTURE SUPPORTS

Carbon steel pipe short strap for piping 1/2" through 2". Fastened with two No. 24 x 2 (minimum size) wood screws. Anvil Figure 262.

Carbon steel coach screw rods machine threaded on opposite ends, minimum 3/8" diameter. Anvil Figure 142.

Carbon steel side beam bracket with minimum 3/8" rod size and fastened with minimum 1/2" x 3" lag screws. Anvil Figure 207

BEAM CLAMPS

MSS SP-58 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior approval. Anvil figure 228.

CONCRETE INSERTS

Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

ANCHORS

Use welding steel shapes, plates, and bars to secure piping to the structure.

ROOF MOUNTED SUPPORTS

HEIGHT OF SUPPORTS:

Based on the length of the longest main support member, the height of the support member above the roof deck to be as follows:

<u>Length of Longest Support Member (inches)</u>	<u>Min. Height of Support Above Finished Roof</u>
Up to 36"	18 inches
37" and Over	36 inches

SUPPORTS 18" OR LESS IN HEIGHT:

Prefabricated Metal Sleeper Curb:

Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing with metal receiver cap Attach a galvanized

steel channel track for securing pipe or duct roller and roller support. Do not use built-in metal base flashings or cants.

Wood Build Sleeper Curb:

Constructed of wood blocking anchored to the deck. The curb must be structurally capable of supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter flashing with metal receiver cap. Attach a steel channel track for securing pipe or duct roller support. Do not use built-in metal base flashings or cants.

Use galvanized structural steel members supported by pipe supports and use pipe or duct rollers fastened to the structural member. Pipe supports to be secured to the roof structure and sealed per pipe penetrations through roof specifications as specified in this section.

PIPE PENETRATIONS THROUGH ROOF

Multiple Pipe Penetrations:

Refer to acceptable Equipment Curb types listed above for curb specifications. An 8" high (minimum) curb height is required. The coping cap shall be constructed from laminated acrylic clad thermoplastic (ABS) with graduated step boots to accommodate various size pipes, stainless steel fastening screws for cover, stainless steel band clamps for securing boots around the pipe, and stainless steel band clamp or mechanical locking seal for securing boots around the ABS coping cap flanges.

Single Pipe Penetrations:

A stack flashing penetration may be utilized for single pipe penetrations through built up roofs and single ply membrane roofs. Utilize high temperature sealant for all high temperature applications. This includes but is not limited to steam condensate vent piping, steam safety relief piping, and flues.

A single pre-manufactured boot may be utilized for single pipe penetrations through single ply membrane roofs only.

PART 3 – EXECUTION

INSTALLATION

Install supports to provide for free expansion of the piping and duct 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.

Piping shall be supported independently from ductwork and all other trades.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.

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:

<u>Pipe Material</u>	<u>Pipe Size</u>	<u>Max. Spacing</u>
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"
Thermoplastic	All sizes	6'-0"
Copper	1/2" through 1-1/4"	5'-0"
Copper	1-1/2" and larger	8'-0"

ANCHORS

Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

ROOF MOUNTED SUPPORTS

Use for all pipe and ductwork on roof. Secure bottom of support flat on roof deck. Apply two coats of zinc rich paint to cut edges of all galvanized steel elements. Flashing and counter flashing by the General Contractor.

EQUIPMENT CURBS

Secure bottom of support flat on roof deck. Secure equipment to curb according to equipment manufacturer's instructions. Flashing and counter flashing by the General Contractor.

Fill the entire void space with compressible fiberglass insulation.

PIPE PENETRATION THROUGH ROOF

Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to the manufacturer's installation instructions. Flashing and counterflashing by the General Contractor.

END OF SECTION 23 05 29

SECTION 23 05 93 – TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 – GENERAL

SCOPE

This section includes air and water testing, adjusting and balancing for the entire project.

RELATED WORK

Section 23 05 00 Common Work Results for HVAC

Section 23 07 00 HVAC Insulation

Section 23 09 23 Direct Digital Control System for HVAC

REFERENCE

Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

REFERENCE STANDARDS

AABC National Standards for Total System Balance, Sixth Edition, 2002.

ASHRAE ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.

NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.

TABB Tab Procedural Guide, First Edition, 2003.

DESCRIPTION

The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.

Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all according to standards published by AABC, NEBB, or TABB.

Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and according to the completion schedule established for this project.

Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

QUALITY ASSURANCE

Qualifications

An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.

A certified member of AABC or certified by NEBB or TABB in the specific area of work performed. Maintain certification for the entire duration of the project.

Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of at least 50% in size, and of similar complexity. Size is defined as the quantity of each specific individual item requiring testing and balancing such as, but not limited to, equipment, devices, terminal devices, and grilles and diffusers.

PRE-INSTALLATION MEETING AND SCHEDULING

The test and balance agency is required to attend a pre-installation meeting with all other project contractors before the construction process is started. The test and balance agency shall give the Lead Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule. Reference General Conditions Article 12 for Lead Contractor responsibilities for scheduling.

PRE-BALANCE CONFERENCE

90 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the Architect/Engineer, Project Representative and the mechanical system and temperature control system installing Contractors. Provide AE with a complete copy of the TAB plan for the project. The objective is final coordination and verification of system operation and readiness for testing, adjusting and balancing procedures and scheduling procedures with the above mentioned parties. Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party responsible for completion of that work.

SUBMITTALS

See also Related Work in this section.

Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB, AABC or TABB Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced according to the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.

Submission:

Distribute electronic copies of the Report to the Contractor and the Project Coordinator

Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:

- General Information
- Summary
- Air Systems
- Hydronic Systems
- Special Systems

Contents: Provide the following minimum information, forms and data:

General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.

Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.

The remainder of the report to contain the appropriate standard NEBB, AABC, or TABB forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

PART 2 – PRODUCTS

INSTRUMENTATION

Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be according to the requirements of NEBB, AABC, or TABB Standards and instrument manufacturer's specifications.

All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by DD upon request. Calibration and maintenance of all instruments to be according to the requirements of NEBB, AABC, or TABB Standards

PART 3 – EXECUTION

PRELIMINARY PROCEDURES

Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.

Notify Project Representative on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

PERFORMING TESTING, ADJUSTING AND BALANCING

Perform testing, adjusting and balancing procedures on each system identified, according to the detailed procedures outlined in the referenced standards except as may be modified below.

Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday.

In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the owner's project representative.

Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.

Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the owner's project representative by giving the representative properly sized motor/drive information (according to manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to owner's project representative. Prior authorization is needed before this work is started.

Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

Final air system measurements to be within the following range of specified cfm:

Fans	0% to +10%
Supply grilles, registers, diffusers	0% to +10%
Return/exhaust grilles, registers	0% to -10%
Room pressurization air	-5% to +5%

Final water system measurements must be within the following range of specified gpm:

Heating flow rates	0% to -10%
Cooling flow rates	-5% to +5%

Contact the temperature control Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

Coordinate and assist CxP with all verification activities defined within section (01 91 01, 02) including providing all required sampling data necessary for the commissioning process.

Verify and record, in the T&B Report, "K" factors for all VAV air terminal devices and air flow stations.

Coordinate air handling unit minimum outside air set points with the Temperature Control Contractor.

HYDRONIC SYSTEM DIFFERENTIAL PRESSURE CONTROL SET POINT

For hydronic systems with variable speed pumping, determine the minimum required system differential pressure set point needed to ensure that all terminal devices are operating at their design water flows with the most demanding terminals device control valve wide open. Provide the differential control setting set point to the DDC temperature control contractor and record them in the T&B report for each system.

DEFICIENCIES

Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the Project Representative of these items and instructions will be issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done at no cost to the State of Wisconsin. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION 23 05 93

SECTION 23 07 00 – HVAC INSULATION

PART 1 – GENERAL

SCOPE

This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment.

RELATED WORK

Section 23 05 00 - Common Work Results for HVAC

Section 23 11 00 - Facility Fuel Piping

Section 23 21 13 - Hydronic Piping

Section 23 83 16 - Radiant-Heating Hydronic Piping

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

Section 23 31 00 - HVAC Ducts and Casings

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C177	Heat Flux and Thermal Transmission Properties
ASTM C302	Density of Preformed Pipe Insulation
ASTM C303	Density of Preformed Block Insulation
ASTM C355	Test Methods for Test for Water Vapor Transmission of Thick Materials
ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
ASTM C921	Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM E84	Surface Burning Characteristics of Building Materials
ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
MICA	National Commercial & Industrial Insulation Standards
NFPA 225	Surface Burning Characteristics of Building Materials
UL 723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions

Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

DESCRIPTION

Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

- Pipe Insulation
- Duct Insulation
- Equipment Insulation

Install all insulation according to the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Project Representative.

DEFINITIONS

Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

ENVIRONMENTAL REQUIREMENTS

Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

Protect installed insulation work with plastic sheeting to prevent water damage.

PART 2 – PRODUCTS

MATERIALS

Manufacturers: Armacell, Certainteed, Manson, Childers, Dow, Extol, Fibrex, Halstead, H.B. Fuller, Imcoa, Johns Manville, Knauf, Owens-Corning, Partek, Pittsburgh Corning, Rubatex, VentureTape or approved equal.

Materials or accessories containing asbestos will not be accepted.

Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 450 when tested according to UL 723 and ASTM E84.

INSULATION TYPES

Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

FLEXIBLE FIBERGLASS INSULATION:

Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.

RIGID FIBERGLASS INSULATION:

Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

SEMI-RIGID FIBERGLASS INSULATION:

Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

ELASTOMERIC INSULATION:

Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor permeability of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

JACKETS

PVC FITTING COVERS AND JACKETS (PFJ):

White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be minimum .02" indoors/.03" outdoors for piping 12" and smaller, .03" indoors/.04" outdoors for piping 15" and larger.

ALL SERVICE JACKETS (ASJ):

Heavy duty, fire retardant material with white kraft reinforced foil vapor barrier, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

FOIL SCRIM ALL SERVICE JACKETS (FSJ):

Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

PROTECTIVE METAL JACKETS (PMJ):

.016 inch thick aluminum or .010 inch thick stainless steel with safety edge.

SELF-ADHERING JACKETS (SAJ):

5-ply, self-adhering multiple laminated waterproofing material with reflective aluminum foil, high density polymer films and cold weather acrylic adhesive providing zero (0.0) permeability. Minimum 6 mils material thickness, 35lb puncture resistance when tested according to ASTM D1000 and flame spread/smoke developed rating of 10/20 when tested according to UL 723.

Vapor retarding tape shall be specifically designed and manufactured for use with the self-adhering jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with self-adhering jackets shall have a maximum permeance of 0.0 perms.

FABRIC REINFORCED MASTIC JACKETS (FMJ):

Glass fiber reinforcing fabric imbedded in weather barrier mastic as per manufacturer's recommended procedure for 2 coat application.

VAPOR RETARDING JACKETS (VRJ):

Polyvinylidene chloride (PVDC) vapor retarding jacket material with minimum 6 mils material thickness and maximum permeance of 0.01 perms. Material shall not support the growth of mold or mildew. Dow Saran or equivalent.

Vapor retarding tape shall be specifically designed and manufactured for use with the vapor retarding jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with vapor retarding jackets shall have a maximum permeance of 0.01 perms.

INSULATION INSERTS AND PIPE SHIELDS

Manufacturers: B-Line, Pipe Shields, Value Engineered Products

Construct inserts with calcium silicate or polyisocyanurate (service temperatures below 300 degrees F only), minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered/premanufactured product described above. On low temperature systems, high density rigid polyisocyanurate may be substituted for calcium silicate provided insert and shield length and shield gauge are increased to compensate for lower insulation compressive strength.

Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of the same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x6" block for piping through 2-1/2" and three 1"x6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/premanufactured product described above.

Wood blocks will not be accepted.

EXPANSION JOINT AND VALVE INSULATION BLANKETS

Manufacturers: Advance Thermal Corporation, TANI Division B.D. Schiffler or approved equal.

Jacket shall be 7 ounce per square yard Teflon coated Nomex fabric which is designed for wet and dry steam applications to 550°F. Equal to Advance Thermal Corp. Steamguard-1 cloth. The covers shall be installed to shed water and have a 1-inch rain flap.

All seams shall be sewn twice with double locked stitching. One seam shall be sewn with 3-ply Nomex and the other with 3-ply stainless steel. Hog rings and staples shall not be used.

The insulation shall be a 2-inch thick, 6 lb. density ceramic fiber which is held in place with 12 gauge stainless quilt pins which do not puncture the inner surface of the cover.

Covers shall be designed to allow access to the expansion and ball joints packing cylinder plungers for repacking with removing the covers.

Adjacent pipe insulation must be installed to allow the piping to expand into expansion joints without damaging the insulation or removable covers.

ACCESSORIES

All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

Tack fasteners to be stainless steel ring grooved shank tacks.

Staples to be clinch style.

Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

Finishing cement to be ASTM C449.

Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

Bedding compounds to be non-shrinking and permanently flexible.

Vapor barrier coatings to have maximum applied water vapor permeance of .05 perms.

Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 – EXECUTION

EXAMINATION

Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.

Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

INSTALLATION

All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.

Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.

Provide a complete vapor barrier for insulation on the following systems:

- Cold Water Make-Up
- Chilled Water
- Refrigerant
- Glycol/Brine
- Insulated Duct
- Equipment, ductwork or piping with a surface temperature below 65 degrees F

PROTECTIVE JACKET INSTALLATION

SELF-ADHERING JACKETS (SAJ):

Install according to manufacturer's recommendations. Cut allowing minimum 4" overlap on ends and 6" on longitudinal joints. Align parallel to surface. Remove release paper and press flat to surface to avoid wrinkles. Rub entire surface for full adhesion and sealing at joint overlaps. On exterior applications, provide a bead of compatible caulk along exposed edges.

Piping with self-adhering (SAJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the self-adhering (SAJ) jacket may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

VAPOR RETARDING JACKETS (VRJ):

Piping with vapor retarding (VRJ) jackets shall have elbows, fittings, valves and butt joints wrapped with two layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the vapor retarding (VRJ) jackets may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

PVC FITTING COVERS AND JACKETS (PFJ):

Lap seams and joints a minimum of 2 inches and continuously seal PVC with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems requiring a vapor barrier, apply a 1-1/2" band of mastic over ends, throat, seams and penetrations.

PROTECTIVE METAL JACKET (PMJ):

Lap seams a minimum of 2 inches. Secure with metal bands for end to end joints, and rivets or sheet metal screws for longitudinal joints. Rivets, screws, and bands to be constructed of the same material as the jacket. Locate seams on bottom for exterior applications.

FABRIC REINFORCED MASTIC JACKETS (FMJ):

Glass fiber fabric shall be fitted without wrinkles. Glass fiber fabric shall be sized immediately upon application with lagging adhesive and shall be capable of drying within 6 hrs. Apply adhesive and coating according to manufacturer's recommendations. All seams shall overlap not less than 2".

PIPING, VALVE, AND FITTING INSULATION**GENERAL:**

Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally secure with staples along seams and butt joints. Coat staples, longitudinal and transverse seams with vapor barrier mastic on systems requiring vapor barrier.

Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required or where roller hangers are not being used, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.

Fully insulate all reheat coil piping, fittings and valves (with the exception of unions) up to coil connection to prevent condensation when coil is inactive during cooling season. Provide a vapor proof seal between the pipe insulation and the insulated coil casing.

INSULATION INSERTS AND PIPE SHIELDS:

Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions, however the inserts shall be no less than 12" in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.

Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

FITTINGS AND VALVES:

Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Where the ambient temperature exceeds 150 degrees F, cover insulation with fabric reinforcing and mastic. Where the ambient temperatures do not exceed 150 degrees, furnish and install PVC fitting covers.

ELASTOMERIC:

Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces. Cover elastomeric insulation on systems operating below 40 degrees F with vapor barrier mastic.

PIPING PROTECTIVE JACKETS

In addition to the jackets specified in the pipe insulation schedule below the following protective jackets are required:

Provide a protective PVC (PFJ) or Fabric Reinforced Mastic (FMJ) jacket for the following insulated piping:

All piping within mechanical rooms

Provide a protective metal (PMJ) or self-adhering (SAJ) jacket for the following insulated piping:

Exterior installed refrigeration piping

PIPE INSULATION SCHEDULE:

Provide insulation on new and existing remodeled piping as indicated in the following schedule:

<u>Service Insulation</u>	<u>Jacket</u>	<u>Insulation Thickness by Pipe Size</u>				
		≤ 1-1/4"	1-1/2"	2" to <4"	4" to 6"	8" and larger
Heating Hot Water Rigid Fiberglass	ASJ	1.5"	1.5"	2"	2"	2"

Note: On 1" or smaller hot water pipe runouts to terminal unit coils the insulation thickness may be reduced to ½" on both the supply and return pipes within 4ft of the coil but not on the distribution system side of the temperature control valve.

Chilled Water Polyiso./Polysty.	VRJ or SAJ	1.5"	1.5"	1.5"	1.5"	1.5"
Refrigerant Suction						
>40°F Elast./Polyol	None	0.5"	1"	1.5"	1.5"	1.5"
40°F to 20°F Elast./Polyol	None	1"	1.5"	1.5"	1.5"	1.5"
Cold Water Piping Rigid Fiberglass	ASJ	0.5"	0.5"	1"	1"	1"
Cooling Coil Rigid Fiberglass	ASJ	0.5"	0.5"	1"	1"	1"
Condensate Drain						

The following piping and fittings are not to be insulated:
Hot water piping inside radiation, convector, or cabinet heater enclosures

For systems with fluid temperatures 65° F or less, furnish and install removable elastomeric insulation covers, plugs or caps for all mechanical equipment and devices that require access by balancing contractors or service and maintenance personnel. Examples include but are not limited to: flow sensing devices, circuit setters, manual ball valve air vents, drain valves, blowdown valves, pressure/temperature test plugs, grease fittings, pump bearing caps, equipment labels, etc. Covers shall be tight fitting to ensure a complete vapor barrier.

DUCT INSULATION

GENERAL:

Secure flexible duct insulation on sides and bottom of ductwork over 24" wide and all rigid duct insulation with weld pins. Space fasteners 18" on center or less as required to prevent sagging.

Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3" from each edge and spaced no greater than 12" on center.

Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed.

Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.

External supply duct insulation is not required where ductwork contains continuous 1" acoustical liner. Provide 4" overlap of external insulation over ends of acoustically lined sections.

Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.

Where insulated low temperature (below 45°F) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.

Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation and vapor barrier jacketing to encapsulate the support channels.

Where ductwork exposed to the weather is insulated with any product other than fluid-applied ductwork insulation, the top surface of the insulation shall be sloped a minimum of 1/4" per foot to eliminate ponding and create positive drainage off of insulation. Refer to fluid-applied ductwork insulation section below for slope requirements.

DUCT INSULATION SCHEDULE:

Provide duct insulation on new and existing remodeled ductwork in the following schedule:

Service	Insulation Type	Jacket	Insulation Thickness
Outside air ducts	Rigid Fiberglass	FSJ	2"
Mixed air ducts	Rigid Fiberglass	FSJ	2"
Exposed supply ducts*	Rigid Fiberglass	FSJ	2"
Concealed supply ducts	Flexible Fiberglass	FSJ	1-1/2"
All Ducts located in unconditioned Attics***	Flexible Fiberglass	FSJ	3"
Exhaust and relief ducts downstream of motorized backdraft dampers	Rigid Fiberglass	FSJ	2"
Louver blank-off panels	Rigid Fiberglass	FSJ	2"

* Exposed supply branch ducts located in the space they are serving do not require insulation. Exposed supply main ducts running through spaces they serve shall be insulated as exposed supply ducts scheduled above.

*** Outside air ductwork between the isolation damper and the outside air intake does not require insulation where it is located in an unheated attic.

EQUIPMENT INSULATION

GENERAL:

Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

SEMI-RIGID FIBERGLASS:

Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place. Fill all joints, seams and depressions with insulating cement to a smooth, even surface. Cover with reinforcing fabric and 2 coats of mastic (FMJ). Use vapor barrier mastic on systems requiring a vapor barrier.

ELASTOMERIC/POLYOLEFIN:

Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

EQUIPMENT INSULATION SCHEDULE:

Provide equipment insulation as follows:

Equipment	Insulation	Jacket	Thickness	Type
Hot Water Air separators		Semi-Rigid Fiberglass	ASJ/FMJ	1.5"
Chilled Water Air separators		Elastomeric/Polyolefin	None	1"
Chilled water compression tanks		Elastomeric/Polyolefin	None	1"
Chilled Water Pumps		Elastomeric/Polyolefin	None	1"
Air Handling Unit Casings or attached component sections not factory insulated**		Rigid Fiberglass	ASJ	2"

END OF SECTION 23 07 00

SECTION 23 09 23 – DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 – GENERAL

SCOPE

Work in this section includes Direct Digital Control (DDC) panels, main communication trunk, software programming, and other equipment and accessories necessary to constitute a complete Direct Digital Control (DDC) system.

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination

Division 23 - HVAC - Equipment provided to be controlled or monitored

Division 26 - Electrical - Equipment provided to be controlled or monitored

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

FCC Part 15, Subpart J, Class A - Digital Electronic Equipment to Radio Communication Interference

QUALITY ASSURANCE

MANUFACTURER:

A firm regularly engaged in manufacture of DDC control equipment similar to the specified equipment and has been in satisfactory similar service for not less than 8 years.

INSTALLER:

A firm specializing and experienced in DDC control system installation for no less than 3 years. All engineering and commissioning work shall be done by qualified employees of this manufacturer, or qualified employees of an Authorized Representative of that manufacturer that provides engineering and commissioning of the manufacturer's control equipment. Where installing contractor is an authorized representative of the control equipment manufacturer, submit written confirmation of such authorization. Indicate in letter of authorization that the installing contractor has successfully completed all necessary training required for the engineering, installation, and commissioning of equipment and systems to be provided for the project and that such authorization has been in effect for a period of not less than three years. The letter of authorization should also indicate that the installing contractor is authorized to install the manufacturer's DDC equipment at the project location at the time the project is bid. Installation of the equipment shall be done by qualified mechanics and/or electricians in the direct employ or be directly subcontracted and under the supervision of the manufacturer or Authorized Representative. The contractor providing and installing the equipment under this

specification section shall be the same contractor providing and installing equipment under the 23 09 14 specification section.

RESPONSE TIME:

During warrantee period, four (4) hours or less, 24-hours/day, 7 days/week.

ELECTRICAL STANDARDS:

Provide electrical products, which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.

DDC Standards: DDC manufacturer shall provide written proof with shop drawings that the equipment being provided is in compliance with F.C.C. rules governing the control of interference caused by Digital Electronic Equipment to Radio Communications (Part 15, Subpart J, Class A).

SUBMITTALS

Include the following information:

Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Indicate which piece of mechanical equipment is associated with each controller and what area within the building is being served by that equipment. For terminal unit control, provide a room schedule that would list mechanical equipment tag, room number of space served, address of DDC controller, and any other pertinent information required for service.

PRODUCT DATA

Submit manufacturer's specifications for each control device furnished, including installation instructions and startup instructions. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked. Annotated software program documentation shall be submitted for system sequences, along with descriptive narratives of the sequence of operation of the entire system involved. Submit wiring diagram for each electrical control device along with other details required to demonstrate that the system has been coordinated and will function as a system.

MAINTENANCE DATA

Submit maintenance data and spare parts lists for each control device. Include this data in maintenance manual.

RECORD DRAWINGS

Prior to request for final payment provide complete composite record drawings to incorporate the DDC and Pneumatic/Electric field work. All software addressing for device communication shall be noted for all devices provided under this section and the communication addressing required for devices provided by others that are integrated into the direct digital control system provided under this section. Point to point routing of communication trunks and power wiring between DDC controllers, DDC communication devices, control panels, and Ethernet switches shall be documented. Coordinate with the

supplier of the equipment specified to be interfaced through digital communications for communication addressing. Provide circuit number of 120VAC panel power circuit(s) feeding each control panel on record drawings. Label circuit number(s) inside the panel served.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

MATERIAL DELIVERY AND STORAGE

Provide factory shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

PART 2 – PRODUCTS

GENERAL

Provide DDC control products in sizes and of capacities as required, conforming to manufacturer's standard materials and components as published in their product information, designed and constructed as recommended by the manufacturer and as required for application indicate.

System shall be capable of operating with 120 VAC power supply, fully protected with a shutdown-restart circuit, and associated hardware and software.

LOCAL CONTROL PANELS

Use control panels with suitable mounting brackets for each supply fan system. Locate panel adjacent to system served.

Fabricate panels of 14 gauge furniture grade steel or 6063-T5 extruded aluminum alloy, totally enclosed on six sides, hinged door and keyed lock, with manufacturer's standard shop painted finish and color.

Provide UL listed cabinets for use with line voltage devices.

Control panels that have devices or terminations that are fed or switch 50V or higher shall enclose the devices, terminations, and wiring so that Personal Protective Equipment (PPE) is not required to service the under 50V devices and terminations within the control panel. As an alternative, a separate panel for only the 50V and higher devices may be provided and mounted adjacent to the under 50V control panel.

Plastic control enclosures will be approved provided all conduits are bonded and grounded.

Provide control panels for all DDC Controllers, ASC's and associated function modules. All controls to be in panels except for terminal unit controllers mounted within the terminal unit equipment enclosure or VAV box controllers designed to be directly mounted on air terminals. Provide terminal unit equipment enclosures with removable cover for all terminal units located in exposed ceilings that completely enclose the DDC controller and allow for conduit terminations.

Permanently label all controls; tag all control wiring.

DIRECT DIGITAL CONTROLS

System to be capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management, and trend data collection.

DDC to consist of Supervisory Controllers, Programmable Controllers, stand-alone Application Specific Controllers (ASC's), Operators Terminals, Operator Workstations, DDC system servers, and other operator interface devices.

The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, ASC's, and operator devices.

The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

NETWORKING/COMMUNICATIONS

The design of the DDC shall be networked. The highest level networking shall use Ethernet and the sub-level networking shall use serial communications. Inherent in the system's design shall be the ability to expand or modify the highest network either via a local area network (LAN), wide area network (WAN), or a combination of the two schemes.

The highest-level DDC communications network shall be capable of direct connection to and communication with a high-speed LAN or WAN utilizing an Ethernet connection. Communication protocol used shall be BACnet/IP.

The supervisory controller shall directly oversee a local network such that communications may be executed directly to and between programmable controllers and ASC's. All operator devices, either network resident or connected via dial-up modems, shall have the ability to access all points and application reports on the network.

Provide serial communication ports on all ASC's for operator's terminal communications with the DDC Controller.

Access to system data shall not be restricted by the hardware configuration of the DDC system.

Global data sharing or global point broadcasting shall allow point data to be shared between programmable controllers and ASC's when it would be impractical to locate multiple sensors.

Network design shall include the following provisions:

- Data transfer rates for alarm reporting and quick point status from multiple programmable controllers and ASC's. The minimum baud rate shall be 9600 baud.
- Support of any combination of programmable controllers and ASC's. A minimum of 32 programmable controllers and ASC's shall be supported on a single local network. The buss shall be addressable for up to 32 ASC's.
- Detection of single or multiple failures of ASC's or the network media.
- Error detection, correction, and re-transmission to guarantee data integrity.
- Use commonly available, multiple-sourced, networking components.
- Use of an industry standard communication transport, such as, ARCNET, Ethernet, and IEEE RS-485 communications interface.

Provide a temporary Ethernet network for communications between supervisory controllers and operator workstation until the building IT network is available for use by the DDC system. The temporary Ethernet network and all other communications required for the DDC system shall be installed as required for specified operation of mechanical equipment so check out and commissioning of the equipment can occur in a timely manner.

BACNET REQUIREMENTS

BACnet of highest level network communications will utilize BACnet/IP over Ethernet and field level communications shall utilize BACnet MSTP. No other communication protocol is acceptable.

All controllers shall provide a Protocol Implementation Conformance Statement (PICS) and BACnet Interoperability Building Blocks (BIBB'S) as required by the American National Standards Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 135-2001, BACnet protocol.

In general all devices shall support the following:

Segmentation Capability

Segmentation requests supported

Segmentation responses supported

Standard Object Types Supported

- Analog input
- Analog output
- Analog value
- Binary input
- Binary output
- Binary value
- Calendar
- Device
- Event enrollment
- Group
- Multistate input
- Multistate output
- Multistate value
- Notification class
- Schedule

Character Sets supported

- ANSI X3.4
- ISO 10646 Universal Character Set-2

All highest level networked supervisory devices shall support the following:

Data Link Layer Option

BACnet Internet Protocol (IP) (Annex J)

Networking Options

BACnet/IP Broadcast Management Device (BBDM)

SUPERVISORY CONTROLLERS

Supervisory controllers shall be microprocessor-based, multi-tasking, multi-user and digital control processors.

Each supervisory controller shall have sufficient memory to support its own operating system and databases including:

- Control processes
- Energy management application
- Alarm management
- Trend data

- Maintenance support applications
- Operator I/O
- Dial-up communications
- Manual override monitoring

The system shall be modular in nature, and shall permit easy expansion through the addition of field controllers, sensors, and actuators.

Supervisory controllers shall provide at least two RS-232C or USB serial communication ports or Ethernet ports for simultaneous operation of multiple operator I/O devices, such as laptop computers, personal computers, and video display terminals.

Supervisory controllers shall monitor the status of all overrides and include this information in the logs and summaries to inform the operator that automatic control has been inhibited.

Each supervisory controller shall continuously perform self-diagnostics, communications diagnostics, and diagnostics of all subsidiary equipment. Supervisory controllers shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each supervisory controller.

Isolation shall provide at all network terminations, as well as all field point terminations, to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high to allow all signal wiring to be run in the same conduit as high voltage wiring acceptable by electrical code.

In the event of the loss of normal power, there shall be an orderly shutdown of the supervisory controller to prevent the loss of data base or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

Upon restoration of normal power, the supervisory controller shall automatically resume full operation without manual intervention.

Should supervisory controller memory be lost for any reason, the supervisory controller shall have the capability of reloading its programming via high speed local area network from the control system archive workstation or server, the local RS-232C port, or telephone line dial-in.

SYSTEM SOFTWARE FEATURES

All necessary software to form a complete operating system, as described in this specification, shall be provided as an integral part of the supervisory controller, and shall not be dependent upon higher level computer for execution.

Control software shall include a provision for limiting the number of times that each piece of equipment may be cycled within any one-hour period.

The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

Supervisory controllers shall have the ability to perform any or all of the following energy management routines:

- Time of day scheduling
- Calendar based scheduling
- Holiday scheduling
- Optimal start
- Optimal stop
- Demand limiting
- Load rolling
- Heating/cooling interlock

All programs to be executed automatically without the need for operator intervention, and be flexible enough to allow user customization. Programs shall be applied to building equipment described in Section 23 09 93 of this specification.

Supervisory controllers shall be able to execute configured processes defined by the user to automatically perform calculations and control routines.

It shall be possible to use any of the following in a configured process:

- Any system-measured point data or status
- Any calculated data
- Any results from other processes
- Boolean logic operators (and, or)

Configured processes may be triggered based on any combination of the following:

- Time of day
- Calendar date
- Other processes
- Events (e.g., point alarms)

A single process shall be able to incorporate measured or calculated data from any and all other ASC's.

A single process shall be able to issue commands to points in any and all other programmable controllers and ASC's on the local network.

Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each supervisory controller shall perform distributed; independent alarm analysis and filtering to minimize network traffic and prevent alarms from being lost. At no time shall the ability of supervisory controllers to report alarms be affected by either operator activity at the local I/O device or communications with other ASC's on the network.

All alarm or point change reports shall include the English language description of each point and the time and date of the occurrence.

The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Users shall have the ability to manually inhibit alarm reporting for each point.

The user shall also be able to define conditions under which point changes need to be acknowledged by an operator and/or logged for analysis at a later date.

Alarms reports and messages shall be directed to an operator device.

In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 60-character alarm message to more fully describe the alarm condition or direct operator response.

Each supervisory controller shall be capable of storing a library of at least 100 messages. Each message may be assignable to any number of points in the panel.

A data collection utility shall be provided to automatically sample, store, and display system data.

Measured and calculated analog and binary data shall be assignable to user definable trends for the purpose of collecting operator specified performance data over extended periods of time. Sample intervals of 1 minute to 24 hours, in one minute or one hour intervals, shall be provided. Each supervisory controller shall have a dedicated buffer for trend data and shall be capable of storing 16 trend logs. Each trend log shall have up to four points trended at 48 data samples each. Data shall be stored at the supervisory controller and up-loaded to the DDC system server when archiving is desired.

Supervisory controllers shall automatically accumulate and store runtime hours for binary input and output points specified in Section 23 09 14 of this specification.

Supervisory controllers shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis, user defined, for user-selected analog and binary pulse input type points.

Totalization shall provide calculation and storage accumulations of up to 9,999,999 units (e.g., KWH, gallons KBTU, tons, etc.).

The totalization routine shall have a sampling resolution of one minute.

The user shall have the ability to define a warning limit. Unique, user specified messages shall be generated when the limit is reached.

The information available from pulse totalization shall include, but not be limited to, the following:

- Peak demand, with date and time stamp
- 24-hour demand log
- Accumulated KWH for day
- Sunday through Saturday KWH usage
- Demand KW annual history for past 12 periods
- KWH annual history for past periods

Supervisory controllers shall have the ability to count events, such as the number of times a pump or fan system is cycled on and off.

The event totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.

PROGRAMMABLE CONTROLLERS

Programmable controllers shall be provided with a software program that shall allow the user to design flexible software algorithms for the control sequences as described in Sections 23 09 14 and 23 09 93 portions of this specification.

Programmable controllers shall support all necessary point inputs and outputs to perform the specified control sequence in a totally stand-alone fashion.

Each programmable controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

Each programmable controller shall support the use of a locally mounted status and adjust panel interface to allow for the local adjustment of all setpoints, temporary override of any input or output points and status of all points directly at the controller. The capabilities of the locally mounted status and adjust panel shall include, but not be limited to, the following information for the programmable controllers to which:

- Display temperatures
- Display status
- Display setpoints
- Display control parameters
- Override binary output control

- Override analog output control
- Override analog setpoints
- Modification of gain and offset constants

All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the programmable controller.

Programmable controllers shall support, but not be limited to, the following configurations of systems to address current requirements as described in Sections 23 09 14 and 23 09 93 portions of this specification, and for future expansion of air handling units:

- Mixed air handling units
- 100 percent outside air handling units
- Boiler or chiller plants with pump logic
- Hot water heat exchangers
- Cooling towers
- Zone pressurization of labs
- Smoke control systems
- Generic system interlocking through hardware

APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

Each supervisory controller shall be able to extend its monitoring and control through the use of stand-alone application specific controllers (ASC's).

Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor based, multi-tasking, real-time digital control processor.

Each ASC shall have sufficient memory to support its own operating system and databases including:

- Control Processes
- Energy Management Applications
- Operator I/O (Portable Service Terminal)

The operator interface to any ASC point or program shall be through the supervisory controller connection to any ASC on the network.

ASC's shall directly support the temporary use of a portable service terminal that can be connected to the ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal shall include, but not be limited to, the following information for the:

- Display temperatures
- Display status
- Display setpoints
- Display control parameters
- Override binary output control
- Override analog output control
- Override analog setpoints
- Modification of gain and offset constants

All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC.

ASC's shall support, but not be limited to, the following configurations of systems to address current requirements as described in Sections 23 09 14 and 23 09 93 portions of this specification, and for future expansion of air handling units:

- Variable Air Volume Terminals
- Reheat Terminals
- Fan Coils
- Unit Ventilators
- Packaged Air Handling Units

All application specific controllers shall be fully programmable. Question and answer or template programming is not acceptable. Control sequences for terminal unit control that utilize devices wired directly to the terminal unit application controller shall be programmed in the application specific controller and shall be stand-alone in function, i.e. occupancy sensing, temperature setpoint setback, etc. Supervisory controllers shall not be involved in the control sequence logic unless it involves sharing data between or from individual terminal unit controllers to be utilized in a global sequence, i.e. trim and respond strategies, terminal unit grouping, etc.

OPERATOR INTERFACE REQUIREMENTS

COMMAND ENTRY/MENU SELECTION PROCESS:

Operator interface software shall minimize operator training through the use of English language prompting and English language point identification.

GRAPHIC-BASED DISPLAYS:

The operator interface shall provide graphic based displays of each system. The point data associated with each system shall dynamically update at a minimum of every 30 seconds. Graphic displays shall be linked to each other to provide a "drill down" capability from main graphic displays to more specific system based displays. Provide a building level graphic display that links to system graphics. For systems that have ASC controlled terminal unit controls, provide a building floor plan with dynamic temperatures shown on the graphic that can be drilled into for more specific terminal information. Points provided

in the graphic shall have the override and adjust capability specified under operator commands.

PASSWORD PROTECTION:

Multiple-level password access protection shall be provided to allow the user/manager to limit control, display, and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.

Passwords shall be exactly the same for all operator devices.

A minimum of three levels of access shall be supported:

- Level 1: Data access and display
- Level 2 = Level 1 + operator overrides and commands
- Level 3 = Level 2 + database generation and modification

A minimum of 4 passwords shall be supported at each supervisory controller.

Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device shall be limited to only those items defined for the access level of the password used to log-on.

Provide user definable, automatic log-off timers of from 1 to 60 minutes to prevent operators from inadvertently leaving devices on-line.

OPERATOR COMMANDS:

The operator interface shall allow the operator to perform commands including, but not limited to, the following:

- Start-up or shutdown selected equipment
- Adjust setpoints
- Override analog and binary outputs
- Add/modify/delete time programming
- Enable/disable process execution
- Lock/unlock alarm reporting for each point
- Enable/disable totalization for each point
- Enable/disable trending
- Enter temporary override schedules
- Define holiday schedules
- Change time/date
- Enter/modify analog alarm limits
- Enable/disable analog alarm limits
- Enable/disable demand limiting
- Enable/disable duty cycle

LOGS AND SUMMARIES:

Reports shall be generated manually, and directed to the displays. As a minimum, the system shall allow the user to easily obtain the following general listing of all points in the system that shall include, but not be limited to:

- Points currently in alarm
- Off-line points
- Points currently in override status
- Points in weekly schedules
- Holiday programming

Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration on the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

SYSTEM CONFIGURATION AND DEFINITION:

All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

The system shall be provided complete with all equipment, software, and documentation necessary to allow an operator to independently perform the following functions:

- Add/delete/modify application specific controllers
- Add/delete/modify points of any type, and all associated point parameters, and tuning constants
- Add/delete/modify alarm reporting definition for each point
- Add/delete/modify energy management applications
- Add/delete/modify time and calendar-based programming
- Add/delete/modify totalization for every point
- Add/delete/modify historical data trending for every point
- Add/delete/modify configured control processes
- Add/delete/modify dial-up telecommunication definition
- Add/delete/modify all operator passwords
- Add/delete/modify alarm messages

PROGRAMMING DESCRIPTION:

Definition of operator device characteristics, ASC's, individual points, and shall be performed through fill-in-the-blank templates.

NETWORK-WIDE STRATEGY DEVELOPMENT:

Inputs and outputs for any process shall not be restricted to a single ASC, but shall be able to include data from any and all other ASC's to allow the development of network-wide control strategies.

SYSTEM DEFINITION/CONTROL SEQUENCE DOCUMENTATION:

All portions of system definition shall be self-documenting and be capable of providing hardcopy printouts of all configuration and application data.

DATA BASE SAVE/RESTORE/BACK-UP:

Backup copies of all programmable controller, ASC and supervisory controller databases shall be stored in at least one personal computer or laptop. Users shall have the ability to manually execute upload and downloading of a programmable controller, ASC and supervisory controller database.

WEB BASED HTML BROWSER INTERFACE

Provide a HTML based browser interface (Web Server) for accessing the DDC system. This shall include all hardware and software to provide an Ethernet twisted pair connection to the owners local or wide area network (LAN or WAN) that can be used to access the DDC system through a standard internet browser.

All information shall be provided to the owners IT staff to facilitate connection through the owners LAN/WAN.

At a minimum, this interface shall be capable of all functions described under the Operator Interface section, Password Protection, Operator Commands, and Logs and Summary subsections of this specification.

PORTABLE OPERATOR TERMINAL

Provide a portable interface for accessing the DDC system from a connection to a supervisory controller. This device shall, at a minimum, be capable of all functions described under the Operator Interface section, Password Protection, Operator Commands, and Logs and Summary subsections of this specification.

PART 3 – EXECUTION**GENERAL**

All electronic work required as an integral part of the Direct Digital Control system work is the responsibility of this section unless specifically indicated otherwise in this section, Section 23 09 14, or in Division 26.

This contractor shall provide all labor, materials, engineering, software, permits, tools, checkout and certificates required to install a complete Direct Digital Control system as herein specified.

Any and all points added with this project shall be grouped for display purposes into the system such that all points associated with a new or existing DDC system can appear together on the CRT display or printed log. Assignment of points to a group shall not be restricted by hardware configuration of the points of direct digital control. It shall be possible to assign a point to appear in more than one system. An English descriptor and an alpha/numeric identifier shall identify each system.

This Direct Digital Control system as herein specified shall be fully integrated and completely installed by this section. It shall include all required computer CPU software and hardware. Include the engineering, installation, supervision, calibration, software programming, and checkout necessary for a fully operational system.

INSTALLATION

All work and materials are to conform in every detail to the rules and requirements of the National Electrical Code and present manufacturing standards. All wiring and cable installation shall conform with the wiring installation as specified in the installation section of Section 23 09 14. All material shall be UL approved.

Install system and materials according to manufacturer's instructions, rough-in drawings and details on drawings.

Line voltage wiring to power the DDC Controllers, not provided by the Division 26 contractor, to be by this contractor.

Control panels serving equipment fed by emergency power shall also be served by emergency power.

Provide uninterruptable power supplies where necessary to provide proper startup of equipment or to accomplish power restart control sequences specified.

Mount control panels adjacent to associated equipment on vibration-free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face.

Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

Cable tray routing of the communication trunks is acceptable.

Where a new system is required to be extended to an existing agency Building Automation Network (BAN) (typically connected via the agency Local Area Network (LAN) or Wide Area Network (WAN)), extension of the data-net between DDC Controllers and to the BAN to be by this contractor unless specified to be provided by the division 27 contractor. All wiring and cable installation shall conform to the wiring installation as specified in the installation section of Section 23 09 14 and division 27.

Provide all necessary routers and or repeaters to accomplish connection to the BAN via the panel-mounted port provided.

Provide two data jacks in control panels housing supervisory controllers and allocate 6"x6" for each data jack in the panel. The first jack will be used for connecting the supervisory controller to the BAN. The second jack will be used as a spare for connecting to the BAN by service personnel.

Provide an input for a service shutdown toggle switch for each air handling unit system provided inside the temperature control panel that will initiate a logical shutdown of the air handling unit system.

All tubing, cable and individual wiring is to be permanently tagged, with numbers corresponding with "Record Drawings", spares are to be labelled as "Spare".

Provide technician to work with air balancing contractor and/or provide balancing contractor with necessary hardware to over-ride DDC controllers for air balancing.

Provide documentation to demonstrate that all points, input and output, have been checked out and verified operational, note any points not operating properly with notation of reason.

END OF SECTION 23 09 23

SECTION 23 11 00 – FACILITY FUEL PIPING

PART 1 – GENERAL

SCOPE

This section contains specifications for fuel pipe and fuel pipe fittings for this project.

RELATED WORK

Section 23 05 23 - General-Duty Valves for HVAC Piping

Section 23 05 15 - Piping Specialties

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI B16.3 Malleable Iron Threaded Fittings

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system according to ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in occupied spaces and ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

WELDER QUALIFICATIONS

Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau.

Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures according to the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

The A/E reserves the right to test the work of any welder employed on the project, at the Contractor's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project.

NATURAL GAS SERVICE

All charges for the gas service as shown on the plans, including the connection from the main in the street or other location to the gas meter, shall be paid by this Contractor, including setting of gas meter(s) and all work performed by the gas company.

PART 2 - PRODUCTS

NATURAL GAS

2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

VENTS AND RELIEF VALVES

Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

UNIONS AND FLANGES

2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi.

PART 3 - EXECUTION

PREPARATION

Remove all foreign material from interior and exterior of pipe and fittings.

ERECTION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

"Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

WELDED PIPE JOINTS

Make all welded joints by fusion welding according to ASME Codes, ANSI B31, and State Codes where applicable.

Electrodes shall be Lincoln, or approved equal, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

THREADED PIPE JOINTS

Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

NATURAL GAS

Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main.

Do not install gas pipe in a ventilation air plenum.

If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five feet above grade.

Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.

Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.

Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

Clean all welded piping before all regulators and control valves. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.

VENTS AND RELIEF VALVES

Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

UNIONS AND FLANGES

Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

PIPING SYSTEM LEAK TESTS

Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

Provide all piping, fittings, blind flanges, and equipment to perform the testing.

Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Division's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

Do not insulate pipe until it has been successfully tested.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

Conduct fuel oil system test so as not to impose a pressure of more than 10 psig on the tank. Instead of a pressure test, suction lines may be tested under a vacuum of not less than 20 inches of mercury maintained for at least one hour.

<u>System</u>	<u>Pressure</u>	<u>Medium</u>	<u>Duration</u>
Natural gas	100 psig	Air	24 hr

All pressure tests are to be documented on a Division of Facilities Development form included in this specification.

On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

END OF SECTION 23 11 00

Piping System Test Report

Date Submitted:_____

Project Name:_____

Location:_____ Project No:_____

Contractor:_____

☐ HVAC	☐ Refrigeration	☐ Controls
☐ Power Plant	☐ Plumbing	☐ Sprinkler

Test Medium: ☐ Air ☐ Water ☐ Other_____

Test performed per specification section No._____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification:_____

Describe Location:_____

Test Date:_____

Stop Test Time:_____ Initial Pressure:_____ PSIG

Stop Test Time:_____ Final Pressure:_____ PSIG

Tested By:_____

Witnessed By:_____

Title:_____

Title:_____

Signed:_____

Signed:_____

Date:_____

Date:_____

Comments:_____

SECTION 23 21 13 – HYDRONIC PIPING

PART 1 – GENERAL

SCOPE

This section contains specifications for all HVAC hydronic pipe and pipe fittings for this project.

RELATED WORK

Section 23 05 23 - General-Duty Valves for HVAC Piping

Section 23 05 15 - Piping Specialties

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

Section 23 07 00 - HVAC Insulation

Section 23 25 00 - HVAC Water Treatment.

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI B16.3 Malleable Iron Threaded Fittings

ANSI B16.4 Cast Iron Threaded Fittings

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A74 Cast Iron Soil Pipe and Fittings

ASTM A105 Forgings, Carbon Steel, for Piping Components

ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A181 Forgings, Carbon Steel for General Purpose Piping

ASTM A197 Cupola Malleable Iron

ASTM A380 Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems

ASTM B75 Seamless Copper Tube

ASTM B88 Seamless Copper Water Tube

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

COPPER TUBE:

Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

QUALITY ASSURANCE

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system according to ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, ASTM A53 grade A type E or S, or ASTM A53 grade B type E or S may be substituted at Contractor's option. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS

Before any metallic welding is performed, the Contractor shall submit his Standard Welding Procedure Specifications, Procedure Qualification Records and Qualification Test Records for each Welder along with associated continuity records to demonstrate compliance with ASME Section IX, paragraph QW-322.

The Contractor shall maintain a complete set of welder qualification documents at the jobsite, including Test Records and Continuity Records for each welder.

The A/E reserves the right to test the work of any welder employed on the project, at the Contractor's expense. Testing will include a visual examination of the pipe and weld and may include radiography of any suspect welds. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project. Any welds deemed unacceptable will be repaired at the contractor's expense.

PART 2 - PRODUCTS

HEATING HOT WATER AND HEAT PUMP INTERIOR WATER SYSTEMS

2" and Smaller: ASTM A53, type F, standard weight (schedule 40) black steel pipe with ASTM A126/ANSI B16.4, class 125, standard weight cast iron threaded fittings.

2-1/2" and Larger: ASTM A53, standard weight (schedule 40) black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

Contractor may use ASTM B88 seamless, type L, hard temper copper tube with ANSI B16.22 wrought copper solder-joint fittings in lieu of steel pipe for all sizes. Mechanically formed tee fittings may be used in lieu of wrought copper solder-joint tee fittings for branch takeoff up to one-half (1/2) the diameter of the main.

MAKEUP WATER

Extend from where left by the Plumbing Contractor with the same materials.

CHEMICAL TREATMENT

Use pipe and pipe fittings as specified for the system to which the chemical treatment piping is connected. Plastic pipe furnished with the chemical treatment materials may also be used if its pressure/temperature rating is acceptable for the service.

VENTS AND RELIEF VALVES

Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

COOLING COIL CONDENSATE

ASTM B88, type L hard temper copper tubing with ASTM B145/ANSI B16.23 cast red bronze or ASTM B75/ANSI B16.29 wrought solder-type drainage fittings.

PART 3 - EXECUTION

ERECTION

Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job site immediately. Excluding minor surface rust, piping that exhibits significant oxidation or corrosion will be rejected.

Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.

Remove all loose dirt, scale, oil, chips, burrs and other foreign material from the internal and external surfaces of all pipe and piping components prior to assembly, including debris associated with cutting, threading and welding.

During fabrication and assembly, remove slag and weld spatter from internal pipe surfaces at all joints by peening, chipping and wire brushing.

During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item of the system. Use plugs, caps, blind flanges or other items designed for this purpose.

Furnish and install all flanges, caps, bypasses, drains, valves, etc. required to facilitate flushing and draining all heating and cooling system piping.

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

"Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

Install drains throughout the systems to permit complete drainage.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves, control valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

WELDED PIPE JOINTS

Make all welded joints by fusion welding according to ASME Codes, ANSI B31, and State Codes where applicable.

All pipe welding shall be completed by Qualified Welders according to the Contractor's Procedure Specifications.

Contractor will ensure that these steps are followed where pipe sections will be joined by welding:

1. Cleaning – Welding surfaces will be clean and free of defects.
2. Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16”.
3. Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.
4. Girth Butt Welds:
 - a. Girth butt welds shall be complete penetration welds.
 - b. Concavity will not exceed 1/32”
 - c. Under cuts will not exceed 1/32”
 - d. As welded surfaces are permitted however surfaces will be free from coarse ripples, grooves, abrupt ridges and valleys.

Electrodes shall be Lincoln, or approved equal, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

THREADED PIPE JOINTS

Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux, and assemble joint. Use 95-5 solder or brazing to secure joint as specified for the specific piping service.

Where mechanically formed tee fittings are allowed, form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint, applying heat properly so that pipe and tee do not distort; remove distorted connections.

WATER SYSTEM

Run water mains level or pitch horizontal mains up 1 inch in 40 feet in the direction of flow. Install manual air vents at all high points where air may collect. If vent is not in an accessible location, extend air vent piping to the nearest code acceptable drain location with vent valve located at the drain.

Main branches and runouts to terminal equipment may be made at the top, top 45 degree, side, and/or bottom 45 degree of the main provided that there are drain valves suitably located for complete system drainage and manual air vents are located at all top and top 45 degree connections. Bottom connections are not acceptable unless approved by the DFD Mechanical Inspector.

Use top or top 45 degree connection to main for upfeed risers and bottom 45 degree connection to main for downfeed risers. Bottom connections are not acceptable unless approved by the DFD Mechanical Inspector.

Use a minimum of two elbows in each pipe line to a piece of terminal equipment to provide flexibility for expansion and contraction of the piping systems. Offset pipe connections at equipment to allow for service, such as removal of the terminal device.

Use eccentric fittings for changes in horizontal pipe sizes with the fittings installed for proper air venting. Concentric fittings may be used for changes in vertical pipe sizes.

MAKEUP WATER

Install where indicated and/or specified, including all valves, piping specialties and dielectric unions required for a functional system.

CHEMICAL TREATMENT

Install chemical treatment piping as indicated on the drawings, as detailed, and as recommended by the supplier of the chemical treatment equipment.

VENTS AND RELIEF VALVES

Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

COOLING COIL CONDENSATE

Trap each cooling coil drain pan connection with a trap seal of sufficient depth to prevent conditioned air from moving through the piping. Extend drain piping to nearest code approved drain location. Construct trap with plugged tee for cleanout purposes as detailed.

UNIONS AND FLANGES

Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

PIPING SYSTEM LEAK TESTS

Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or

isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

Provide all piping, fittings, blind flanges, and equipment to perform the testing.

Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Division's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

Do not insulate pipe until it has been successfully tested.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

<u>System</u>	<u>Pressure</u>	<u>Medium</u>	<u>Duration</u>
Heating hot water	100 psig	Water	8 hr

On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Do not penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

HYDRONIC PIPING SYSTEM FLUSHING

All new chilled water and heating hot water system piping shall be flushed thoroughly before the systems are put in to operation. Subsequent to executing the chemical cleaning processes specified in Section 23 25 00 – HVAC WATER TREATMENT, and prior to adding scale and corrosion inhibitors, flush all piping and components with a clean source of water until the discharge from the system is clean. Discharge shall be from drains provided at all low points in the piping, ends of headers and as otherwise necessary to flush and drain the entire system.

Project specific procedures shall be established prior to flushing. Before beginning flushing operations, submit proposed flushing procedures to the A/E and DFD's Project Representative for review and approval. Provide sufficient notice to the A/E and/or DFD to allow the flushing operations to be observed.

A clean water source shall be tapped into the system downstream of the main circulation pump(s). Provide minimum 2" connection between water source and hot water/chilled water systems including taps with ball valves (or line size tap and ball valve for piping systems smaller than 2"). Provide minimum 2" taps (or line size if mains are smaller than 2") at the ends of headers, the low point of each of the mains on each floor and as otherwise necessary to flush and drain the entire system. Provide minimum 2" bypass with shut off valve (or line size if mains are smaller than 2") between the supply and return mains on each floor as where directed by the A/E and DFD Project Representative or where shown on the drawings. Contractor shall identify proposed clean water source along with the method/location of drain discharge and review with the A/E and DFD Project Representative prior to installing flushing connections to water source and drain outlets. Provide code required temporary backflow prevention for the clean water source if needed. Provide all temporary taps, valves, piping, bypasses and hoses as needed to accomplish flushing procedures. The Agency's district chilled water system shall NOT be used as a source of water for flushing any piping.

Flush piping systems using the following procedure:

Flushing sequence for hot water and chilled water systems is as follows:

1. Close isolation valves at all coils and wall fin.
2. Open the temporary bypasses that connect the ends of supply and return mains.
3. Flush mains by turning on flushing water source and sequentially opening drains on mains on each floor until the discharge is clean. This will flush the mains without forcing water/debris into the branches and run out pipes.
4. Close isolation valves located downstream of coils/wall fin.
5. Open isolation valves located upstream of coils/wall fin.
6. Open individual drain valves upstream of coils/wall fin until the discharge is clean. This will flush the supply branch and run out lines between the mains and the coils/wall fin without running water/debris through the TCV or coils/wall fin.
7. Close the individual drain valves upstream of coils/wall fin.
8. Open drain valves at low points in the return piping mains.
9. Open the individual isolation valves located downstream of the coils/wall fin. This will flush the return branch and run out lines located between the coils/wall fin and the mains back into the mains and out the drains on the return mains. The water going through the coil/wall fin should be already be clean since this section was flushed previously.

10. Repeat steps 1-3 to clean debris from the mains.

Isolate all coils while flushing risers and mains. Flush the mains on each floor individually, starting at the top of the building and working down towards the basement level. After risers and mains have been flushed clean, individually open the drain valves in each branch circuit to discharge any debris that may have accumulated in the branch piping.

After flushing operations are complete, drain and/or blow out any residual water, clean and replace all strainers, and add scale and corrosion inhibitors as specified in Section 23 25 00. Leave flushing connections/valves in place and cap.

All flushing procedures shall be documented by completing and submitting the report form included at the end of this Section.

INITIAL FILL AND VENT

Fill hydronic systems with appropriate working fluids as specified. All system fluids shall be chemically treated as specified in Section 23 25 00 – HVAC WATER TREATMENT.

For closed piping systems, all air trapped at high points shall be relieved through the manual air vents prior to notifying A/E that the systems are ready to be tested and balanced.

END OF SECTION 23 21 13

PIPING SYSTEM LEAKAGE TEST REPORT

Date Submitted:_____

Project Name:_____

Location:_____ DFD Project No:_____

Contractor:_____

☐ HVAC	☐ Refrigeration	☐ Controls
☐ Power Plant	☐ Plumbing	☐ Sprinkler

Test Medium: ☐ Air ☐ Water ☐ Other_____

Test performed per specification section No. _____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification:_____

Describe Location:_____

Test Date:_____

Stop Test Time:_____ Initial Pressure:_____ PSIG

Stop Test Time:_____ Final Pressure:_____ PSIG

Tested By:_____

Witnessed By:_____

Title:_____

Title:_____

Signed:_____

Signed:_____

Date:_____

Date:_____

Comments:_____

PIPING SYSTEM FLUSHING REPORT (revised 10/1/2012)

Date Submitted: _____

Project Name: _____

Location: _____ DFD Project No: _____

Contractor: _____

System Identification (check one):

☐ Chilled Water ☐ Process Chilled Water ☐ Heat Reclaim

☐ Heating Hot Water ☐ Other _____

Describe procedure: _____

Flush Date: _____ Start Time: _____ Stop Time: _____

Pressure of Water Source: _____ PSIG

Describe water source and method of connection to source: _____

PIPING SYSTEM FLUSHING REPORT (page 2)

Flushed By: _____

Witnessed By: _____

Title: _____

Title: _____

Company: _____

Agency: _____

Signed: _____

Signed: _____

Date: _____

Date: _____

Comments: _____

Describe results: _____

SECTION 23 21 23 – HYDRONIC PUMPS

PART 1 – GENERAL

SCOPE

This section includes specifications for water pumps used for HVAC applications.

RELATED WORK

Section 23 05 13 - Common Motor Requirements for HVAC Equipment

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Include data concerning dimensions, capacities, materials of construction, ratings, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

Pump curves shall identify design point of operation.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

Pump sizes, capacities, pressures and operating characteristics shall be as scheduled.

Pumps shall meet or exceed operating efficiencies scheduled.

Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard, and other accessories specified. Statically and dynamically balance all rotating parts. Provide flanged connections on all pumps unless specified otherwise. Service or repair of base mounted pumps shall not require breaking piping connections or removal of motor.

Where a pump is specified for parallel operation, the scheduled conditions are for that pump with both pumps operating; i.e., total system flow rate is twice that scheduled for a single pump. When only one of the parallel pumps is operating, the operating point of that pump must fall within the manufacturer's recommended operating range.

Provide pump with a motor sized for non-overloading over the entire pump curve. Motors to be 1750 rpm unless specified otherwise.

Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

Test all pumps, clean and paint before shipment. The manufacturer shall certify all pump ratings.

All pumps to operate without excessive noise or vibration.

After completion of balancing, provide replacement of impellers, or trim impellers to provide specified flow at actual pumping head, as installed.

Furnish one spare seal and casing gasket for each pump to user agency.

PART 2 – PRODUCTS

IN-LINE CENTRIFUGAL PUMPS

MANUFACTURERS:

Bell and Gossett, Armstrong, Thrush, Taco, Grundfos, Aurora, or approved equal.

TYPE:

Single stage, direct connected, resiliently mounted motor for in-line mounting, oil lubricated, 175 psig maximum working pressure at operating temperature of 225 ° F. continuous, 250 ° F. intermittent.

CASING:

Cast iron or stainless steel; flanged suction and discharge connection; with plugged taps for vent, drain, suction and discharge gauges.

IMPELLER:

Brass or bronze, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

BEARINGS:

Two, oil lubricated bronze sleeves or ball bearings capable of being greased.

SHAFT:

Stainless steel or carbon steel with stainless steel or bronze sleeve, integral thrust collar.

SEAL:

Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

DRIVE:

Close coupled.

GLYCOL FILL PUMP

Provide one portable mixing tank and electric fill pump assembly. The mixing tank shall be constructed of corrosion resistant material, with 25 gallon capacity. Pump shall have a capacity of 3 to 5 gpm at 20 psig fill pressure. Provide threaded hose adapter for pump discharge, and electrical cord for standard 120 volt outlet.

PART 3 – EXECUTION**INSTALLATION**

Install all pumps in strict accordance with manufacturer's instructions. Access/service space around pumps shall not be less than minimum space recommended by pump manufacturer.

Support piping adjacent to pump such that no weight is carried on pump casings.

Decrease from line size at pump connections with suction diffusers where specified, long radius reducing elbows or concentric reducers/increasers in the vertical piping, and eccentric reducers/increasers for horizontal piping. Install eccentric reducers/increasers with the top of the pipe level

All valves and piping specialties must be full line size as indicated on the drawings

Install a full line size spring loaded check valve and balancing valve in the pump discharge piping. At contractor's option, combination shut-off, check, balancing valve may be substituted instead of separate valves. Reference section 23 05 23.

GLYCOL FILL PUMP

After initial system fill, turn pump over to owner

END OF SECTION 23 21 23

SECTION 23 25 00 – HVAC WATER TREATMENT

PART 1 – GENERAL

SCOPE

This section includes specifications for chemical treatment of all water, steam, and condensate systems.

REFERENCE

Applicable provisions of Division 1 shall govern work under this Section.

RELATED WORK

Section 23 05 15 - Piping Specialties

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Required for all equipment and chemicals specified including data concerning dimensions, capacities, materials of construction, weights, operating sequence, composite wiring diagrams and appropriate identification. Chemical data to include the description of the chemical, its composition, its function, and the associated material safety data sheet.

OPERATION AND MAINTENANCE DATA

Provide for the services of the manufacturer's trained representative to approve the installation and instruct the user agency in the operation of each system.

Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

DESIGN CRITERIA

Recommend a periodic test procedure and chemical treatment program for each system.

Treat the following systems:

- Glycol water

Provide the initial chemical treatment for all systems based on a complete system fluid analysis prior to the equipment installation. The initial chemical treatment supply of chemicals for each system shall be adequate for the start-up and testing period, for the time the systems are being operated by the Contractor for temporary heating and cooling, and for one year after start-up of the system.

Provide electrical devices, motors, wiring and conduit according to the applicable sections of the Electrical Specifications.

MAINTENANCE SERVICE

Furnish service and maintenance of treatment systems for one year from date of substantial completion.

Provide 2 technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

Provide laboratory and technical assistance services for the warranty period.

Include 2 hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of the treatment systems. Arrange course at startup of systems.

Provide site inspection of equipment during scheduled shutdown to evaluate success of the treatment program. Make recommendations in writing based on these inspections.

PART 2 – PRODUCTS

MANUFACTURERS

Betz Entac, Dearborn Div. - W. R. Grace & Co., Fremont Industries, Mitco Water Labs, Mogul Corporation, Nalco Chemical Co., Western Water Management, or approved equal.

SYSTEM CLEANER

Blend of organic alkaline penetrants, emulsifiers, surfactants and corrosion inhibitors that remove grease and petroleum products from the interior of piping systems. Cleaners that contain trisodium phosphate are specifically not acceptable.

GLYCOL

Inhibited ethylene glycol based material specifically designed for use in closed heat transfer systems. Dow Chemical Dowtherm SR-1, Union Carbide UCARTHERM, or approved equal.

TREATMENT EQUIPMENT

BYPASS FEEDER:

5 gallon minimum capacity, 125 psig working pressure, either a screw type cover or a valved funnel opening to feed chemical into the system, prime coat of paint.

Bypass feeder is used for initial cleaning duty only.

AUTOMATIC GLYCOL FEEDER

Based on products by Wessels Company. Equal products will be acceptable.

Automatic glycol feeder shall be a factory assembled unit consisting of glycol reservoir, pump, automatic pressure-based controls, pressure gauge, all required valving, and fully wired.

Reservoir shall have a minimum storage capacity of 18 gallons. Reservoir shall be translucent so fluid quantity is visible and shall have graduations marked on the tank for visual indication of fluid level. Graduations in minimum intervals of one gallon.

Pump shall be self-priming and close-coupled to the motor not requiring coupling, belts, or similar transmission.

The control system shall function from an internal pressure switch which automatically starts the feed pump when the building system pressure falls below the set point. The supplied pressure switch shall have a range adjustable between 0-50 PSI.

The unit shall have a pressure gauge connected to the system side of the assembly to monitor system pressure.

Include an internal check valve so system pressure does not push back against the pump or into the reservoir.

All controls and pump shall be factory wired at 120 VAC 60 HZ. The assembly shall be equipped with a plug and cord for connection to a standard NEMA 5-20R receptacle.

PART 3 – EXECUTION

PREPARATION

Prior to cleaning, verify that systems are operational, filled, started, and vented. Use water meter to record capacity in each system.

Place terminal control valves in the full-open position

CLEANING SEQUENCE

GENERAL:

Systems are to be cleaned before they are used for any purpose except conduct pressure test before cleaning. Add cleaner to closed systems at concentrations as recommended by the manufacturer. Remove water filter elements from the system before starting circulation. For steam systems, fill boilers only, using the water and cleaner solution.

Use neutralizer agents on recommendation of the system cleaner supplier and approval of the Architect/Engineer.

Flush open systems with clean water for one hour minimum. Drain completely and refill.

Remove, clean, and replace strainer screens.

Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

HOT WATER HEATING SYSTEMS:

Add cleaner to the system water until the M alkalinity value is 250 above that of the initial fill water. Verify the M alkalinity level before and after the addition of the cleaner by means of chemical tests that are observed by the Owner's construction representative; include results of all tests in the Operating and Maintenance manuals. Apply heat while circulating, slowly raising temperature to 160°F and maintain for 12 hours minimum; vent all high points to assure 100% system circulation. Remove heat and circulate to 100°F or less; drain system as quickly as possible and refill with clean water. Circulate for 6 hours at design temperature, vent air at all high points, then drain. Refill with clean water and repeat until the system cleaner is removed and the M alkalinity level returns to normal. Remove and clean all strainers. Re-vent the system and install clean filter elements in water filters. Treat with scale and corrosion inhibitors before using the system for building heating or cooling.

GLYCOL WATER SYSTEMS:

Clean and flush as indicated above for hot water heating systems. Verify complete drainage by measuring amount of water used for the initial fill versus the amount actually drained to assure complete removal of the cleaning solution. Remove all traces of chloride from the system; test to verify this removal and submit test results.

GLYCOL WATER SYSTEMS

All water systems for this project shall be glycol water systems.

Completely flush all traces of cleaning chemicals before adding the glycol water mixture to the system. Verify this by chemical test.

Premix the glycol water solution in a polyethylene drum to a concentration of 25% by volume. Use domestic water supply on site to make the solution. Use a hand pump to fill system from the mixing tank. Circulate fluid for several hours, vent all high points where air may collect, add more solution to the system if needed, and test the system for proper concentration of glycol; include copy of test report in the Operating and Maintenance manuals.

Once system is initially filled, fill the automatic glycol feeder to full capacity and connect to the system. Open valves and all system pumps to operate under normal control. Monitor fluid level in glycol feeder for 90 days. At the completion of 90 days, re-fill glycol feeder unit to maximum capacity and feed in fully automatic position.

END OF SECTION 23 25 00

SECTION 23 31 00 – HVAC DUCTS AND CASINGS

PART 1 – GENERAL

SCOPE

This section includes specifications for all duct systems used on this project.

RELATED WORK

Section 23 01 30.51 – HVAC Air Duct Cleaning

Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

Section 23 33 00 – Air Duct Accessories

REFERENCE

Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

ANSI SS-EN 485-2	Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties
ASTM B209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM A90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
ASTM A623	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A527	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
ASTM C 1071	Specification for Fibrous Glass Duct Lining Insulation
ASTM C 411	Test Method for Hot Surface Performance of High Temperature Thermal Insulation
90A	Standard for the Installation of Air Conditioning and Ventilating Systems
UL 181	Standard for Safety for Factory Made Air Ducts and Air Connectors.
NAIMA	Fibrous Glass Duct Liner Standard

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Include manufacturer's data and/or Contractor data for the following:

- Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.

- Duct sealant and gasket material.
- Duct liner including data on thermal conductivity, air friction correction factor, and limitation on temperature and velocity.

DESIGN CRITERIA

Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:

- HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
- HVAC Air Duct Leakage Test Manual, 1st Edition, 1985
- HVAC Systems - Duct Design, 4th Edition, 2006

Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

DELIVERY, STORAGE AND HANDLING

Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

Protect Ductwork against damage.

Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.

Offsite storage agreements do not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

GENERAL

All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12” and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

DUCTWORK PRESSURE CLASS

Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application.

MATERIALS

GALVANIZED STEEL SHEET:

Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 according to ASTM A90. Provide "Paint Grip" finish or galvaneal sheetmetal for ductwork that will be painted.

Seal all joints and seams watertight

DUCT SEALANT

Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal, or approved equal. Silicone sealants are not allowed in any type of ductwork installation.

Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

GASKETS

2 INCH PRESSURE CLASS AND LOWER:

Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

PART 3 – EXECUTION

INSTALLATION

Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, according to SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage.

Test openings for test and balance work will be provided under Section 23 05 93.

Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including

equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.

Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.

Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized sheet metal backing on both sides.

Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

Provide adequate access to ductwork for cleaning purposes.

Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.

Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the Ductwork.

During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

DUCTWORK SUPPORT

Support ductwork according to SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.

Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching fastener rated for 50% of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.

LOW PRESSURE DUCT (Maximum 2 inch pressure class)

Seal all duct, with the exception of transfer ducts, according to SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheetmetal screws or pop rivets. Trapeze hangers may be used at contractor's option.

CLEANING

Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

END OF SECTION 23 31 00

SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 – GENERAL

SCOPE

This sections includes accessories used in the installation of duct systems.

RELATED WORK

Section 23 05 29 – Hanger and Supports for HVAC Piping and Equipment

Section 23 31 00 – HVAC Ducts and Casings

REFERENCE

Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems

SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995

UL 214

UL 555 (6th edition) Standard for Fire Dampers and Ceiling Dampers

UL 555S (4th edition) Leakage Rated Dampers for Use in Smoke Control Systems

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

PART 2 – PRODUCTS

MANUAL VOLUME DAMPERS

Manufacturers: Ruskin, Vent Products, Air Balance, or approved equal.

Dampers must be constructed according to SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

TURNING VANES

Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley, or approved equal.

Construct turning vanes and runners for square elbows according to SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn according to SMACNA Fig. 2-5 and Fig. 2-6.

FIRE DAMPERS

Manufacturers: Air Balance, Advanced Air, American Warming and Ventilating, Greenheck, Phillips-Aire, Prefco, Ruskin, Safe-Air or approved equal.

STATIC FIRE DAMPERS

Static fire damper assemblies must be UL 555 (6th edition) listed and labeled for static applications (where air systems do not operate during a fire) and meet requirements of NFPA 90A. Damper must be type B curtain type with blades out of the air stream; dampers with blades in the air stream will not be accepted. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS

Manufacturers: Ruskin, Johnson Controls, Air Balance, Advanced Air, American Warming and Ventilating, Greenheck, Safe-Air, Phillips-Aire, Prefco, or approved equal.

Smoke damper assemblies to be UL 555S(4th edition) listed and labeled, and leakage rated at no higher than Class II under UL 555S(4th edition). Unless ratings are indicated elsewhere, dampers should be rated for minimum 2,000 fpm air velocity and 4" static pressure.

Combination fire/smoke damper assemblies to be UL 555(6th edition) and UL 555S(4th edition) listed and labeled, and have a fire rating compatible with the rating of the building

assembly in which the damper is used, and be leakage rated at no higher than Class II under UL 555S.

Provide factory installed [pneumatically][electrically] operated dampers with linkage arranged so that the damper is closed on loss of [pneumatic air pressure][power]. For electric actuation, provide electric operated dampers with linkage and UL listed operators arranged so that the damper is closed on a loss of power. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Locate all operators out of the air stream unless large damper size will not allow. Provide form "C" end switches to indicate damper position.

Use airfoil shaped damper blades on the following system:

CONTROL DAMPERS

Control dampers are specified in section 23 09 14.

SMOKE DETECTORS

Smoke detectors are furnished and installed by the Electrical Contractor.

ACCESS DOORS

Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non-hinged doors provide sufficient number of cam sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

Use insulated, 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

FLEXIBLE DUCT

Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster or approved equal.

Factory fabricated , UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under according to NFPA 90A.

Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch pressure class, depending on the application.

Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.

Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

DUCT LINING

Manufacturer: Manville, Owens-Corning, Knauf, or approved equal.

1 inch thick, flexible, mat faced insulation made from inorganic glass fibers bonded with a thermosetting resin with thermal conductivity of .25 Btu inch / hour sq.ft. deg F.

Meet erosion testing per UL 181 or ASTM C 1071 for 5000 fpm maximum air velocity. ASTM C 411 maximum operating temperature rating of 250 deg F. ASTM E84 flame spread less than 25 and smoke developed less than 50.

Meet requirements of ASTM C 1338 and ASTM G21 for fungi resistance.

Install liner using adhesive conforming to ASTM C 916.

FLASHINGS

Provide flashing to completely weatherproof connection of ductwork to louvers. Flashing to be constructed of material similar to louver material.

Flashing and counterflashing for roof curbs will be provided by others.

Flashing and curbs for duct and pipe penetrations of roof assemblies to be according to details.

DUCT FLEXIBLE CONNECTIONS

Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.

Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.

Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard. Material used for outdoor applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with Hypalon, air and water tight, suitable for temperatures between -10°F and 250°F, and have a nominal weight of 26 ounces per square yard.

HOODS FOR INTAKE AND EXHAUST

Manufacturers: Acme, Ammerman, Carnes, Cook, Greenheck, Louvers and Dampers, Penn, or approved equal.

Use low silhouette type hoods.

Use louvered penthouse type hoods with drainable blade louvers.

Construct hoods of aluminum.

Construct hoods of galvanized steel with a baked enamel finish; color to be selected by the Architect during the submittal stage.

Provide bird screen and motor operated damper for each hood.

LOUVERS

Louvers are specified in the architectural section of these specifications.

Manufacturers: Airolite K6776, Industrial Louvers 658, American Warming and Ventilating LE-31, Construction Specialties 6177, Ruskin ELF6375DX or approved equal.

Similar to Airolite Type K6776, extruded aluminum alloy not less than 12 gauge (.081" thick), 6063 series frame and blades, all-welded assembly, 35 degree or 45 degree blades with water baffle, 6 inches thick. Provide with bird screen of ½" x ½" mesh aluminum in 12 gauge aluminum frame and an aluminum sill. [Locate the bird screen on the outside of the louver where indicated on the drawings.] Locate the bird screen inside of the louver unless noted otherwise.

Louver to bear the AMCA certified ratings seal for both air performance and water penetration, having a free area not less than 50% based on a 48" x 48" section, a water penetration less than 0.1 oz/square foot under AMCA test at 1000 feet per minute, and an intake pressure drop less than 0.20 inches of water at 1000 feet per minute.

Finish to be anodized or Kynar 500 in a custom color to be selected by the Architect. Furnish sufficient paint in the same color as the louver to paint the outer surface of panels over unused portions of louvers and to paint the interior portion of ductwork visible through the louvers.

PART 3 – EXECUTION

MANUAL VOLUME DAMPERS

Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

TURNING VANES

Install turning vanes in all rectangular, mitered elbows according to SMACNA standards and/or manufacturer's recommendations.

Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheet metal turning vanes according to SMACNA Figure 2-5 and Figure 2-6.

FIRE DAMPERS

Install dampers in strict accordance with manufacturer's installation instructions. Install damper sleeves with retaining angles on both sides of rated partition. Connections of ductwork to fire damper assemblies to be as specified on the installation instructions. Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper replacing the fusible link.

Manually test each fire damper for proper operation by removing the fusible link. Repair or replace any fire damper that does not close completely. Re-install fusible link after test.

SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS

Install smoke dampers in locations indicated on the drawings according to the manufacturer's instructions. Install an access door adjacent to each damper for inspection and cleaning. Coordinate damper linkage with operators so the dampers are closed when the air system is not operating.

Install combination fire/smoke dampers as specified above for fire dampers. Coordinate damper linkage with operators so the dampers are closed when the air system is not operating.

CONTROL DAMPERS

Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

SMOKE DETECTORS

Installation and wiring of detectors will be by the Electrical Contractor. Install an access door at each detector location.

ACCESS DOORS

Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, "SMOKE DAMPER" or "FIRE DAMPER". Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

FLEXIBLE DUCT

Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.

Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheet metal screws and/or duct tape will not be accepted.

Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.

Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.

Penetration of any partition, wall, or floor with flexible duct will not be accepted.

DUCT LINING

Apply lining to the following ductwork: (As scheduled on the Drawings.)

Do not apply lining to the following ductwork:

Outside air ductwork.

Shower exhaust ductwork.

Install liner in compliance with the latest edition of NAIMA's Fibrous Glass Duct Liner Standard. Locate longitudinal joints at the corners of duct only. Cut and fit to assure lapped, compressed joints. Coat all transverse and longitudinal joints and edges with adhesive. Provide metal nosing on leading edge where lined duct is preceded by unlined duct. Adhere liner to duct with full coverage area of adhesive. Additionally secure liner to duct using mechanical fasteners spaced as recommended by the liner manufacturer without compressing liner more than 1/8" with the fasteners.

FLASHINGS

Flashing for roof curbs, equipment supports or rails located on roof, will be installed by others.

DUCT FLEXIBLE CONNECTIONS

Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment according to SMACNA Figure 2-19. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

For applications in corrosive environments or fume exhaust systems, use a double layer of the Teflon[®] coated fabric when making the connector.

HOODS FOR INTAKE AND EXHAUST

Install in locations indicated on the drawings, coordinating the roof opening location with the General Contractor. Curbs are covered in Section 23 05 29.

LOUVERS

Louvers are furnished by the Mechanical Contractor and installed by others.

Furnish louvers to the General Contractor for mounting in exterior walls. Connect outside air intake duct to the louver, sealing all connections air and water tight.

Provide bird screen on inside of active louver area where none is provided with louvers. Where louvers are equipped with inside bird screen, remove screen at all locations where duct connections are not made.

Install insulated metal panel on unused portion of louver. Panels must be sealed weathertight to louver assembly with flashing as required for proper drainage to outside of building. Paint outside surface of panel to match louver prior to installation. Where ductwork is visible through louver when viewed from outside the building, paint inside of duct to match louver color.

END OF SECTION 23 33 00

SECTION 23 34 00 – HVAC FANS

PART 1 – GENERAL

SCOPE

This section includes specifications for fans that are not an integral part of a manufactured device.

RELATED WORK

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

Section 23 05 13 - Common Motor Requirements for HVAC Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

AMCA 203 AMCA Fan Application Manual - Troubleshooting

AMCA 210 Laboratory Method of Testing Fans for Rating

AMCA 300 Reverberant Room Method for Sound Testing of Fans

NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems

NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

UL 762 Power Roof Ventilators For Restaurant Exhaust Appliances

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Include dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification and vibration isolation for all equipment. Sound power levels to be based on tests performed according to AMCA Standard 300.

Submit color selection charts for equipment where applicable.

Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Brake horsepower, recommended selection range, and limits of operation are to also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.

For variable air volume application, include data which indicates the effect of capacity control devices, such as inlet vanes, on performance.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

Tested and certify all fans according to the applicable AMCA test code.

Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.

Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.

Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to prevent uneven airflow or improve mixing.

All internal insulation and other components exposed to the airstream are to meet the flame spread and smoke ratings contained in NFPA 90A.

All roof mounted equipment to be provided with curbs or equipment stands according to specification in Section 23 05 29.

PART 2 – PRODUCTS

GENERAL

Use fan size, class, type, arrangement, and capacity as scheduled.

Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. All single phase motors to have inherent thermal overload protection.

Provide variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Design all drives for 150% of motor rating.

Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal to allow for ventilation; provide tachometer openings at shaft locations.

Statically and dynamically balance all fans so they operate without objectionable noise or vibration.

IN-LINE FANS

Manufacturers: CFM, Fan-tech, or approved equal.

Construct housing of formed steel with reinforcing to prevent distortion. Furnish with integral inlet and outlet duct connections. Direct drive fans suitable for use with variable speed motor control mounted in the airstream. Permanently-lubricated bearings. Standard painted finish.

Design all vertically mounted fans to withstand the vertical thrust loads.

Provide all accessories as Scheduled.

POWER ROOF EXHAUST FANS

Manufacturers: Carnes, Greenheck, Penn, Jenn-Air, Cook, ACME, or approved equal.

Provide upblast or downblast units, as scheduled, with aluminum housing, non-overloading type centrifugal wheel, inlet cone, factory mounted and wired motor and disconnect switch, and bird screen.

Electrical Contractor will provide disconnect switches and thermal overload protection for units with three phase motors.

Upblast units to have motor, bearings, and drives completely enclosed and isolated from the exhaust air stream with ventilation provided by outside air. Units handling grease laden vapors to be U.L. listed for conveying such vapors, operating continuously at 300 degrees F.

PART 3 – EXECUTION**INSTALLATION**

Install as shown on the drawings, as detailed, and according to manufacturer's installation instructions. On units provided with a drain connection, reduce drain connection down to 1/2" fitting and leave open.

Install thrust restraints according to the requirements of Section 23 05 48.

Contractor shall balance blade assembly of destratification fans after installation to assure stable operation.

END OF SECTION 23 34 00

SECTION 23 34 35 – LARGE DESTRATIFICATION FANS

PART 1 – GENERAL

SCOPE

RELATED WORK

Division 16

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

UL 507/CSA Electric Fans

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Include data concerning dimensions, capacities, and material of construction, ratings, weights, manufacturer's installation requirements and performance limitations.

Submit manufacturer's installation instructions including required clearance to structural members.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DELIVERY, STORAGE AND HANDLING

Comply with manufacturer's instructions for storing, rigging, unloading, and transporting units. Protect units from physical damage. Leave factory-shipping covers in place until installation.

WARRANTY

Provide a one year parts and labor warranty on the entire unit beginning upon substantial completion of project.

Provide a 15 year parts warranty on the entire fan assembly.

PART 2 – PRODUCTS

LARGE DE-STRATIFICATION FANS

Manufacturers: Big Ass Fans or approved equal product.

Fan shall be a Big Ass Fan Model “Powerfoil X2.0” provided in 14 foot diameter configuration.

Fan shall be equipped with a 1.5 HP motor suitable for variable speed operation.

Provide factory-assembled reduction gearbox so fan has a maximum speed of 95 RPM (plus/minus 15% for equal products).

Provide and install a remote-mounted fan speed controller with single line input, integral disconnecting means, “on-off” manual selector switch, and fully adjustable speed selector switch. Controller shall be suitable for 240 VAC, single phase power supply.

Fans with controllers mounted on the fan assembly and a remote control panel accessible from the floor will be acceptable.

Provide redundant safety features consisting of airfoil retainers, hub clips, safety cables, and minimum Grade 8 bolts and fasteners.

PART 3 – EXECUTION

The Mechanical Contractor is responsible to supply the fan and to physically mount the fan to the structure. Provide and install supplemental structural steel mounted components (angle iron, etc.) to support fan. Construct a mounting base suitable for mounting of the fan per the fan manufacturer’s directions.

Any structural steel support fabricated by the Mechanical Contractor shall be submitted to the Architect for review by the structural engineer prior to final fabrication and installation. Include accurate description of materials proposed to be used and method for fabrication.

Mount the fan at the correct elevation to maintain clearances from structural members and mechanical ductwork as recommended by the fan manufacturers. Fans shall be mounted as high as possible, but verify all roof pitches as necessary.

Mount fan and secure to mounting base in full compliance with the fan manufacturer’s directions. Install all safety devices supplied by the fan manufacturer. Manually rotate blades to ensure they meet all clearance requirements before connecting power to fan.

Fans shall be balanced by the Mechanical Contractor per the manufacturer’s directions.

Wall-mounted controls shall be turned over to the Electrical Contractor for mounting and wiring. Supply the Electrical Contractor with manufacturer-provided field wiring diagrams and supply any information to the Electrical Contractor.

Provide the services of a factory-authorized start-up technician to perform all pre-start inspection services and to perform initial start-up of the fans.

END OF SECTION 23 34 35

SECTION 23 37 13 – DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

SCOPE

This section includes specifications for air terminal equipment.

RELATED WORK

Section 23 31 00 - HVAC Ducts and Casings

Section 23 33 00 - Air Duct Accessories

Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

UL 181 - Factory-Made Air Ducts and Connectors.

ARI-ADC Standard 880

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS

Refer to division 1, General Conditions, Submittals.

Furnish submittal information including, but not limited to, the following:

1. Manufacturer's name and model number
2. Identification as referenced in the documents
3. Capacities/ratings
4. Materials of construction
5. Sound ratings
6. Dimensions
7. Finish
8. Color selection charts where applicable
9. Manufacturer's installation instructions
10. All other appropriate data

DESIGN CRITERIA

All performance data shall be based on tests conducted according to Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 – PRODUCTS

MANUFACTURERS

Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price, and United Sheet Metal.

Acceptable manufacturers for specific products are listed under each item.

LINEAR SLOT DIFFUSERS

Titus Series ML, Carnes Series CH, Metal Aire Series 6000, Price Series SDS

Extruded aluminum with frame type appropriate to installation with diffuser elements being removable from frame. Both air pattern and flow rate adjustment with air pattern having full 180-degree adjustment. Single slot diffuser vanes segmented on 2 or 3 foot centers.

Diffuser lengths and slot sizes as shown on drawings and/or as scheduled.

White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior.

Provide diffusers with uninsulated galvanized steel plenum. Plenums constructed for specific diffuser frame & border type. Provide round or oval inlet collar designed to fit standard flexible duct sizes.

LINEAR BAR DIFFUSERS AND GRILLES

Titus Series CT, Carnes CC, CT or CW, Metal Aire Series 2000, Price series LBP.

Extruded aluminum with frame type appropriate to side wall, sill or ceiling installation as indicated.

Diffuser and grille lengths, blade spacing and blankoff strips as shown on drawings and/or as scheduled.

Where frame and border types allow provide diffusers used for supply air with straightening or equalizing vanes. Fixed blades at 0 or 15 degree deflection as scheduled. Bar support maximum 9" spacing.

White, anodized aluminum finish unless otherwise indicated

Provide alignment strips/wires for end-to-end joining of sections for a continuous appearance when scheduled lengths exceed standard manufacturer lengths.

ROUND CEILING DIFFUSERS

Titus Series TMRA, Carnes Series SSAA, Metal Aire Series 3100, Price Series RCDA

Spun aluminum or steel with uniform 360° discharge pattern.

Adjustable inner cones surrounded by a ceiling plate collar designed to reduce ceiling smudges.

Diffusers as shown on drawings and/or as scheduled.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

SQUARE CEILING DIFFUSERS - Plaque

Titus model OMNI, Carnes series SFPA/SHPA, Price model SMDP, Metal Aire series 5750, and Krueger series PLQ/5PLQ.

Aluminum (Steel) unless otherwise indicated, louvered face furnished with frame type appropriate to installation.

Directional blow pattern as shown on the drawings and/or as scheduled.

One-piece removable square face plaque with one-piece backpan.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

SQUARE CEILING DIFFUSERS

Titus model TDC/TDC-AA, Carnes series SK or SE, Price model SMD/AMD, Metal Aire series 5500 or 5500S, and Krueger series S.

Aluminum (Steel) unless otherwise indicated, louvered face furnished with frame type appropriate to installation.

Directional blow pattern as shown on the drawings and/or as scheduled.

One-piece construction louver cones with no corner joints.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

PLENUM SLOT DIFFUSER – 180 degree adjustable

Titus model TBD-30, Carnes model DA, Price model TBD3, Metal Aire series 6600, and Krueger series PTBA, Raymon-Donco Series SAT/XC.

Steel, furnished with T-bars compatible with ceiling components. Vane air pattern and flow rate adjustment with air pattern having full 180-degree adjustment.

Provide 24 gauge galvanized steel (uninsulated) insulated plenum,. Provide round or oval inlet collar designed to fit standard flexible duct sizes.

Double metal thickness slot face.

White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior.

SIDE-WALL REGISTERS AND GRILLES

Titus series 300 (supply) and series 350 (return/exhaust), Carnes model R series, Price model 520 (Supply) or 530 (return/exhaust), Metal Aire series V4000 or H4000, Krueger series 880.

Aluminum (Steel) unless otherwise indicated, with frame type appropriate to installation.

Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.

Opposed blade volume control damper supply registers, operable from face.

Fixed blade (0 degree, 45 degree) core return and exhaust registers and grilles.

Opposed blade volume control damper return registers, operable from face.

Register and grille sizes as shown on drawings and/or as scheduled.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

Screw holes on surface counter sunk to accept recessed type screws.

EGGCRATE GRILLE

Titus model 50, Carnes model RAE or RAT, Price model 80, Metal Aire model CC, Krueger model EGC.

Aluminum construction with frame type appropriate to installation.

Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1" deep with a minimum of 85% free area.

Grille sizes and finishes as shown on drawings and/or as scheduled.

White, baked enamel finish or powder coat finish, unless otherwise indicated..

Screw holes on surface counter sunk to accept recessed type screws.

HEAVY DUTY SIDE-WALL RETURN/EXHAUST GRILLE

Titus model 30, Carnes Sturdicore, Price 91, Metal Aire series SBG, Krueger series 480, Price model 91.

Grille border 16-gauge steel and grille blades 14-gauge steel suitable for gymnasium applications.

Fixed blade (0 degree, 45 degree).

Grille sizes as shown on drawings and/or as scheduled.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

DOOR GRILLE

Titus Series 700, Carnes Series RF or RG, Metal Aire Series DG, Price ATG/STG

Aluminum (Steel). Sight tight.

Grille sizes, frame types, and finishes as shown on drawings and/or as scheduled.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

PART 3 – EXECUTION

INSTALLATION

Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.

Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

Seal connections between ductwork drops and diffusers/grilles airtight.

Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.

Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

In clean rooms and animal holding rooms, caulk space between diffuser or grille and ceiling or wall to be air and watertight. Use clear, non-hardening silicone sealant compatible with ceiling or wall surfaces. Sealant shall be resistant to microbiological growth.

END OF SECTION 23 37 13

SECTION 23 52 00 – HEATING BOILERS

PART 1 - GENERAL

SCOPE

This section includes specifications for hot water and steam heating equipment.

RELATED WORK

Section 23 21 13 – Hydronic Piping

Section 23 05 23 – General Duty Valves for HVAC Piping

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASME CSD-1 Control and Safety Devices for Automatically Fired Boilers

ASME Boiler and Pressure Vessel Code IV - Rules for Construction of Heating Boilers

NFPA 70 National Electric Code

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions

ENERGY EFFICIENCY

All boilers with a capacity of 300,000 btu/hr input must meet the efficiencies specified. Minimum boiler efficiencies are based on Federal Energy Management Program (FEMP) recommendations.

SUBMITTALS

Refer to division 1, General Conditions, Submittals.

Include data concerning dimensions, capacities, and material of construction, ratings, weights, manufacturer's installation requirements and performance limitations.

Submit manufacturer's installation instructions including required clearance to combustible materials.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

REGISTRATION

Complete Boiler and Unfired Pressure Vessel (UPV) Installation Registration and forward to the Department of Safety and Professional Services according to the Wisconsin Administrative Code Chapter SPS 341.24.

WARRANTY

Sealed combustion boiler, condensing, hi-efficiency, (modular,) helical heat exchanger/combustion chamber design that will be self-supporting, and warranted for a period of 10 years to withstand thermal shock. Heat exchanger shall be warranted against leakage for period of 10 years.

PART 2 – PRODUCTS

HIGH EFFICIENCY CONDENSING BOILER

SEALED COMBUSTION BOILER, STAINLESS STEEL WATER TUBE, CONDENSING, MODULAR (GIANNONI HEAT EXCHANGER)

Manufactures: Camus – Dynamax, HTP, Peerless – Pinnacle, Munchkin, Laars – Neo Therm, NTI – New York Thermal

Provide units with capacity and operating characteristics indicated on schedules.

Boiler ASME stamped. Boiler designed and tested per ANSI Z21.13. Furnish a relief valve in compliance with ASME section IV, and set at 30 psig. All internal combustion chamber, and internal burner components, shall be manufactured with stainless steel materials suitable to withstand constant operation under condensing conditions. Combustion chamber shall be sealed and completely enclosed and shall have a condensate drain to discharge any condensate buildup.

Boiler minimum efficiency of 94%+ per BTS 2000, and operation in the condensing mode with inlet temperatures as low as 90 F.

Pre-mix stainless steel burner design to allow modulation of fuel and air for a minimum of 5:1 turndown.

Combustion air intake capable of accepting either free mechanical room air, or direct outside air through a sealed intake pipe of the length and diameter shown on drawings and of material required by the Boiler manufacturer. Provide inlet/outlet combustion vent temperature fittings with direct outside air application.

Category II, III, or IV flu vent connection as appropriate for installation, for vertical, horizontal and sidewall venting. The vent outlet shall be compatible with installation.

Baked enamel finish Boiler metal jacket with removal panels for maintenance access.

Inlet and outlet temperature gauge to monitor inlet and outlet water temperatures.

Provide a microprocessor controller capable of pre-purge, post purge, burner modulation and boiler operation; adjustable temperature differential set points; LED diagnostic light to indicate normal operation and to assist with troubleshooting; a set of dry pump contacts; and a set of trouble alarm contacts.

PART 3 – EXECUTION

INSTALLATION

Install units as shown on plans, as detailed, and according to manufacturer's installation instructions.

Set units on concrete housekeeping pads.

Install all items shipped loose by equipment manufacturer under supervision of equipment manufacturer's field service personnel.

BOILERS

After piping system has been flushed, boil out boilers using chemical and procedure as recommended by boiler manufacturer. Perform boil-out under supervision of boiler manufacturer's representative.

Manufacturer shall verify in writing that boilers have been cleaned according to their recommendations and are ready for operation.

Isolate boilers from piping system during boil-out.

Pipe vents from gas train to atmosphere. Size of each vent shall not be less than connection size to device.

Pipe boiler drains to nearest floor drains.

Owner's representative and/or engineer will observe boil-out. Contractor must notify engineer at least 72 hours prior to boil-out.

Install gas pressure gauges at downstream of gas pressure regulators.

END OF SECTION 23 52 00

SECTION 23 54 00 – INFRARED GAS FIRED HEATING UNITS

PART 1 – GENERAL

SCOPE

RELATED WORK

Section 23 05 00 - Common Work Results for HVAC

Section 23 11 00 - Facility Fuel Piping

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI Z223.1 National Fuel Gas Code

NFPA 70 National Electric Code

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Submit infrared heating unit shop drawings including the following information: specific manufacturer and model numbers, dimensional and weight data, required clearances, materials of construction, capacities and ratings, stages of capacity, component information, size and location of piping connections, electrical connections, wiring diagrams and information for all specialties and accessories.

Submit manufacturer's installation and start-up instructions, maintenance data, troubleshooting guide, parts lists, controls and accessories.

At substantial completion, submit warranty certificate and copy of start-up report.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DELIVERY, STORAGE AND HANDLING

Comply with manufacturer's instructions for storing, rigging, unloading, and transporting units. Protect units from physical damage. Leave factory-shipping covers in place until installation.

Ship units to jobsite fully assembled

WARRANTY

Provide a one year parts and labor warranty on the entire unit beginning upon substantial completion of project.

PART 2 – PRODUCTS

INFRARED HEATING UNITS

Manufacturers: Detroit Radiant, Reznor, Superior or approved equal.

General

Radiant Heater Unit System shall be provided that is:

- CGA approved
- fitted for Natural Gas and LPG operation
- complete with hangers, thermostats, vent terminals, and/or other accessories as noted on the plan.

Heaters shall be provided with a low/high firing rate and a heat exchanger length as scheduled on the Drawings.

Manufacturer's published warranty covering all components for a period of 36 months and covering the heat exchanger for a period of at least 120 months shall be supplied.

Clearance to combustibles shall be as specified.

Approved stainless steel flexible gas connectors shall be provided.

The Heater Unit shall operate at a minimum inlet gas pressure of 5 in. W.C. for Natural Gas and 11 in. for LPG, and draw no more than 1A @ 120VAC, 60Hz.

Equipment Components

Ignition shall be direct spark with ignition taking place within the burner cup for reliability.

Ignition control shall:

- make 3 ignition attempts before lockout
- recycle again in one hour with 3 ignition attempts
- have a lighted diagnostic display capability
- have openly accessible sense current measurement contacts within the housing
- have a blower post purge function
- accept 24V thermostat wiring

Air blower motor shall be totally enclosed, requiring no oiling and shall be equipped with a thermal overload switch.

Gas and electric controls shall be separated from the combustion air stream.

The burner shall be serviceable from either side while in operation.

Burner shall be equipped with clearly visible power ON and HIGH FIRE lights

Gas valve shall be of the slow opening type.

Air pressure proving switch shall be an integral part of burner safety control system.

Burner housing shall be constructed of 18ga corrosion resistant steel and coated with powder epoxy paint.

Outside air adapters and flue connectors shall be provided as standard equipment.

Combustion air inlet hood and vent terminals shall be provided as standard equipment.

Burner box surface temperature shall not exceed 27 C (80 F) at any point during operation.

All operating components shall be enclosed in sealed burner housing.

Burner shall be equipped with a flame sight port safely usable while the unit is running during service.

Reflectors shall be mill finish aluminum, ASTM 1100, with 10 reflective surfaces.

Reflector material shall be at least 0.024 inches thick (per CGA code).

Reflector end caps shall be supplied as standard and fitted to the end of each reflector run to reduce convective heat loss.

Reflectors shall extend below the bottom surface of the radiant tube.

Directing of radiant pattern shall be accomplished through use of side shields or bottom shields only.

Couplings shall be of aluminized steel, be twelve inches in length with two draw bands of 2 inch wide by 0.0625 (16ga) aluminized steel.

Radiant heat exchanger tubing shall be seamless welded 16ga thick either heat treated aluminised steel or stainless steel.

Two stage gas valve

Burner box is sealed with silicone in the corners and joints

Rubber gaskets are used instead of fiber

Weather resistant electrical components are used for exterior connections

PART 3 – EXECUTION

Installation must comply with manufacturer supplied Instruction Manual, all applicable local codes and/or gas utility requirements. In the absence of any of the former, reference should be made to CAN 1-B149.1 and B149.2 Installation Codes in Canada and ANSI Z223.1 in the US.

Heater units must be wired according to the National Electric Code, ANSI/NFPA 70 in the US, as well as local ordinances.

Heater Units shall be suspended according to manufacturer's instruction with chair and turnbuckles exceeding 150lb pull test. (3/8 - 4inch turnbuckles and 2/0 chair).

The Mechanical Contractor is responsible for all hanging support of the heaters. Provide supplemental angles, channels, and similar structural steel items.

All low voltage wiring is the responsibility of the Mechanical Contractor. All low voltage wiring shall be routed in EMT conduit.

Provide and install digital room thermostats for the heaters. A single thermostat may control both heaters. When commonly vented, the infrared heaters may be "master-slave" configured and operated simultaneously.

END OF SECTION 23 54 00

SECTION 23 57 33 – VERTICAL GROUND LOOP HEAT EXCHANGER, PIPE AND ACCESSORIES

PART 1 – GENERAL

SCOPE

RELATED WORK

Section 23 05 23 - General-Duty Valves for HVAC Piping

Section 23 05 15 - Piping Specialties

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

Section 23 07 00 - HVAC Insulation

Section 23 25 00 - HVAC Water Treatment.

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM D1693	Standard Test for Environmental Stress Cracking of Ethylene Plastics.
ASTM D2239-03	Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D2683-04	Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled PE Pipe and Tubing
ASTM D3350	Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
ASTM D 3261-03	Standard Specification for Butt Heat Fusion PE Plastic Fittings for PE Pipe and Tubing International Ground Source Heat Pump Association (IGSHPA)

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Submit manufacturer's catalog sheets, specifications, and installation instructions for each item specified.

QUALITY ASSURANCE

Geothermal System Installer's Qualifications Data:

- Name of each person who will be performing the geothermal work and their employer's name, business address and telephone.
- Names and addresses of 3 similar projects that each person has worked on.
- Copy of installer's personal experience demonstrating the use of thermal fusion techniques for polyethylene piping.

- The persons performing geothermal work shall be personally trained in polyethylene pipe fusion techniques by IGSHPA or piping manufacturer, personally experienced in geothermal work and shall have been regularly employed by a Company performing geothermal work for a minimum of 2 years.

Geothermal System Supervisor's Qualifications Data:

- Name of person overseeing the geothermal work and their name, business address and telephone number.
- Names and addresses of 3 similar projects that the supervisor has overseen during the past 5 years.
- Copy of installer's personal experience demonstrating the use of thermal fusion techniques for polyethylene piping.
- The supervisor overseeing the geothermal work shall be personally trained in polyethylene pipe fusing techniques by IGSHPA or piping manufacturing, personally experienced in geothermal work, and shall have been regularly employed by a Company performing geothermal work for a minimum of 2 years.

Geothermal System Contractor's Qualifications Data:

- Names and addresses of 3 geothermal projects that the contractor has completed during the past 5 years.
- The contractor shall have completed geothermal work on at least 3 projects with vertical boreholes within the last 5 years.

IGSHPA Installation Manuals: Maintain one copy on site for review. CSA C448-02: Maintain one copy on site for review.

REGULATORY REQUIREMENTS

Perform field testing of piping systems in complete accordance with the local utilities and other agencies having jurisdiction and as specified.

PRODUCT CONDITION

Protection: During test work, protect adjacent buildings, equipment, vehicles, etc., against damage from testing activities.

SEQUENCING AND SCHEDULING

Transmit written notification of proposed date and time of tests to the engineer at least 2 (two) days in advance of such tests.

Perform cleaning and testing work in the presence of Owner's Representative.

WARRANTY

Manufacturer's Warranty: Minimum 50 years warranty for polyethylene piping.

Special Warranty: 25 years for butt fusion welds in polyethylene piping against leakage.

WATER, SILT AND SOIL CONTAINMENT AND REMOVAL

The Contractor shall submit a detailed proposal outlining his proposed methodology for containing, removing and runoffs created by the well drilling and piping installation.

Dewater each borehole during drilling utilizing an interceptor and water sump tank arrangement. Remove water from site in a manner according to all authorities having jurisdiction.

PART 2 – PRODUCTS

HIGH DENSITY POLYETHYLENE (P.E.) PIPE AND FITTINGS

- Pipe and fittings shall be manufactured based on polymers made with ethylene as the sole monomer, which meet the requirements of PE Type III for water distribution.
- PE Type III pipe shall have a 23.2 kPa design stress at 23°C which is listed by the plastics pipe institute (PPI).
- The piping shall be PE3408 (high density polyethylene) with minimum cell classification 345434C per ASTM D 3350. Resistance to environmental stress cracking is critical to long life expectancy. Therefore, as a more stringent requirement, the piping shall experience zero failures (Fo) after 5,000 hours under condition “C” (100% reagent @ 100°C) when tested according to ASTM D1693. A 50 year limited warranty (in writing) must be issued by the pipe manufacturer. U-type fittings shall be shop fabricated under quality controlled conditions of the same material designation and shall be ASTM D-3261 certified.
- Pipe shall conform to ASTM D3035 and ASTM D3261 for butt fusion fittings. U-bend joints shall be butt heat fused or socket welded.
- Pipe must be designed and fabricated by manufacturer specifically for geothermal heat pump applications.
- The complete assembly of piping within the borehole must be continuous without any joints except at the bottom U-BEND located where only a thermally fused joint or socket welded joint will be acceptable.
- All piping shall be sealed at the factory and contain a compressed air charge. The presence of the air charge must be witnessed at the site prior to hydrostatic testing. Piping without an air charge will not be accepted.

ANTI-FREEZE

Provide a 25% by volume solution of polypropylene glycol charge and water for all the entire ground source heat pump closed loop piping.

The performance characteristics shall be as follows:

- Viscosity shall be no more than 5.00 centipoise at –1.1°C with blend for –9.4°C freeze protection.
- Specific heat shall be 1.05 at 21°C with blend for –9.4°C freeze protection.
- Specific gravity shall be 0.982 at 10°C with blend for –9.4°C freeze.
- Pressure drop and Reynolds Number for a 11.3 l/m flow in NPS ¾ SDR-11 PE pipe of a –1.1°C mixture for a –9.4°C freeze protected blend shall be no more than 0.86 m of HD per 30.0 m of pipe and no less than Re = 2028 respectively.
- The fluid shall mix easily and readily with water and shall not damage or corrode common tools.

The fluid shall have a good or excellent material compatibility with iron, copper, red and yellow brass, polyethylene, PVC, Viton, Buna “n” neoprene and nylon and shall include an oxygen scavenger blend to reduce any corrosion capability. The fluid shall not have a low surface tension to prevent leakage.

The fluid shall have a NFPA 704 Health rating of 0 (least risk).

The Contractor shall provide a certified test report from a recognized lab stating glycol concentration.

The product shall be available in plastic 19 liter pails, plastic 208 liter drums, or bulk tanker.

BOREHOLE GROUT

Provide grout for each of the boreholes as indicated on the drawings.

Grout to be a single composite bentonite grout consisting of 25% solids and polymer free mixed with water as follows: 68L water per 22.7 kg bentonite grout.

PART 3 – EXECUTION

GEOHERMAL BOREHOLE PIPING INSTALLATION

The contractor shall obtain all necessary permits associated with the described work.

The borehole drilling contractor shall be experienced in deep bore hole drilling and shall have a minimum of 10 years drilling experience within the geographic vicinity of the project or shall subcontract to an approved drilling contractor with equivalent experience.

The vertical holes shall be drilled no closer than 8.0 m apart and shall be held open by a “mud” casing so that the piping can be inserted. The piping shall be tested according to other sections of this specification prior to insertion. Loops must be installed from or by a mechanical device so that the pipe is not rolled out on the ground before installation.

Install polyethylene piping according to details on drawings.

The piping shall be capped and protected for future connection.

Approved borehole seals should be tightened to manufacturer’s specifications.

The entire piping system shall be pressure tested according to other sections of this specification before any backfilling of trench is permitted.

The Owner’s Representative shall be notified 24 hours prior to the test and shall, at his discretion, witness the test.

The contractor shall maintain an accurate record of all borehole locations and at the completion of the work, deliver to the owner a set of “as-built” site plans.

GROUTING BOREHOLE

Bore holes in vertical heat exchangers shall be tremi-grouted. Grouting of vertical heat exchangers shall be done according to jurisdictional requirements of IGSHPA standards. Grouting shall immediately follow the completion of drilling and installation of each borehole piping. A large capacity grout mixer/separate holding tank are required and a minimum of 25mm diameter polyethylene tubing shall be used as the tremi-grout pipe. The tremi-grout pipe shall be attached to the u-bend heat exchanger before it is lowered into the ground.

Grouting procedures to be as follows:

- Monitor the grouting operation to ensure grout is being adequately mixed in correct proportions and that the viscosity is adequate for pumping down the borehole.
- The grout contractor should have spare grout pipes, hoses, fittings, readily available on site.
- A screw-type pump or a piston pump shall be used to pump grouts down the boreholes.
- A 75 to 100 mm inside diameter suction line and a 25 to 50 mm discharge line shall be used.
- Bentonite based grout shall be used mixed with water in proportions recommended by manufacturer. For Volclay Grout II (25% solids) utilize a mixture of 68 L per 22.7 kg of grout. Cement based grout will not be used.

PIPING SYSTEMS TEST

The contractor shall provide all necessary equipment and shall perform all work required in connection with all piping system tests.

At the water working pressure of the pipe installed, all water piping systems shall be tested. Each section tested shall be slowly filled with water. Care shall be taken to expel all air from pipes. If necessary, the pressure, as measured at the point of lowest elevation, shall be applied for not less than 1/2 hour. When the test pressure has fallen over 5%, the point of leakage shall be found, repaired and tested repeated. This procedure shall be followed until the piping systems have been proved absolutely tight. The use of any chemicals, any “Stop-Leak” compounds, any mastic or any other temporary means shall not be used for repairing leaks during or subsequent to these tests.

Polyethylene pipe testing:

- Prior to insertion of the vertical pipe, the contractor shall assembly the “U Bend” and piping, cap both ends, and air pressure test the piping to a pressure of 862 kPa. The test must be maintained for 8 hours minimum without the pressure falling more than 20 kPa.

Loops shall pass the test at the following milestones:

- Before insertion into hole.
- After insertion into hole.

Contractor is responsible to provide evidence of and certification of pressure testing, and acceptance of all work performed by signature of the Owner's Representative.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.5 FIELD QUALITY CONTROL

A. Piping Tests: Fill piping 24 hours before testing and apply test pressure to stabilize piping. Use potable water only.

B. Hydrostatic Tests: Test at not less than 1-1/2 times the pipe working-pressure rating allowing for static pressure of borehole depth.

1. Increase pressure in 50-psig (345-kPa) increments and inspect each joint between increments. Hold at test pressure for 30 minutes. Slowly increase to next test pressure increment and hold for 30 minutes. After testing at maximum test pressure, reduce pressure to 30 psig (207 kPa). Hold for 90 minutes, and measure pressure at 30-minute intervals. Repair leaks and retest until no leaks exist.

C. Prepare reports of testing activity and submit to RE/COTR.

END OF SECTION 23 57 33

SECTION 23 72 00 – AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 – GENERAL

SCOPE

This section includes specifications for energy recovery equipment that is used to recover heating and/or cooling energy.

REFERENCE

Applicable provisions of Division 1 govern work under this Section.

RELATED WORK

Section 23 07 00 - HVAC Insulation

Section 23 33 00 - Air Duct Accessories

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS

Refer to division 1, General Conditions, Submittals.

Include unit dimensions, weights, materials of construction, thermal characteristics, ratings, fabrication methods, manufacturer's installation requirements, and appropriate identification.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DESIGN CRITERIA

Capacity, efficiency, and operating characteristics as indicated on the drawings and/or as scheduled.

PART 2 – PRODUCTS

AIR-TO-AIR HEAT EXCHANGERS (Fixed plate type) MANUFACTURERS:

Renewaire or approved equal. (Fixed media must be total energy transfer type.)

GENERAL

Product Specification

- Energy Recovery Ventilator (ERV) shall be a packaged unit and shall transfer both heat and humidity using static plate core technology.

Quality Assurance

- The energy recovery ventilator shall be Certified by the Home Ventilating Institute (HVI) under CSA 439. Both a heating and a cooling test must be run to demonstrate year round energy recovery.
- Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
- Unit shall be Listed under UL 1812 Standard for Ducted Air to Air Heat Exchangers. The unit must pass commercial flammability requirements and shall not be labeled “For Residential Use Only”.
- The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of five years from the date of purchase.

PERFORMANCE

Energy Transfer

- The ERV shall be capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.

Passive Frost Control

- The ERV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10°F and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be allowed.

Continuous Ventilation

- Unit shall have the capacity to operate continuously without the need for bypass, recirculation, pre-heaters, or defrost cycles under normal operating conditions.

Positive Airstream Separation

- Water vapor transfer shall be through molecular transport by hygroscopic resin and shall not be accomplished by “porous plate” mechanisms. Exhaust and fresh airstreams shall travel at all times in separate passages, and airstreams shall not mix.

Laminar Flow

- Airflow through the ERV core shall be laminar over the products entire operating airflow range, avoiding deposition of particulates on the interior of the energy exchange plate material.

CONSTRUCTION

The energy recovery component shall be of fixed-plate cross-flow construction, with no moving parts.

No condensate drain pans or drains shall be allowed and unit shall be capable of operating in both winter and summer conditions without generating condensate.

The unit case shall be constructed of 24-gauge steel, with lapped corners and zinc plated screw fasteners. The case shall be finished with textured, powder coat paint (GR90 case shall be constructed of G90 galvanized steel.)

Access doors shall provide easy access to blowers, ERV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets.

Case walls and doors shall be fully insulated with 1 inch, expanded polystyrene foam insulation faced with a cleanable foil face on all exposed surfaces.

The ERV cores shall be protected by a MERV-8 rated, spun polyester, disposable filter in both airstreams.

The unit shall have a line-cord power connection and be supplied with an internal 24 VAC transformer and relay (G90 shall have hardwired line voltage connection and be controlled by line voltage controls provided by others.)

Standby power draw shall not exceed 1 Watt for the unit along with an optional automatic control.

PART 3 – EXECUTION

Unit Location

- Locate and orient unit to provide the shortest and most straight duct connections. Provide service clearances as indicated on the plans. Locate units distant from sound critical occupancies.
- Use integral mounting flange and hanging bar system to mount the unit to a structurally suitable surface. The units may be mounted in any orientation.

Vibration Isolation

- Utilize factory supplied vibration isolation kit following instructions.
- Provide flexible duct connections at unit duct flanges.

Duct Design

- All ductwork shall be designed, constructed, supported and sealed according to SMACNA HVAC Duct Construction Standards and pressure classifications.
- At a minimum all duct runs to the outdoors shall be thermally insulated at levels appropriate to the local climate. A continuous vapor barrier shall also be provided on warm surface of the insulation.

Sound Control

- To control sound radiated from the unit:
- Provide acoustic treatment in mechanical room walls and ceilings.
- To control sound associated with the two blower outlets:
- Utilize insulated, flexible duct.
- In sound critical applications provide increased duct sizing and consider the use of sound attenuators.

Test and Balancing

- Test and Balancing may not begin until 100% of the installation is complete and fully functional.
- Follow National Comfort Institute (NCI) air test and balance procedures specific to Heat Recovery Ventilator Balancing Procedure including standard reports to the owner's representative.

END OF SECTION 23 72 00

SECTION 23 73 33.16 – MAKE-UP AIRE UNITS (GAS-FIRED) AND RELATED ACCESSORIES

PART 1 – GENERAL

SCOPE

RELATED WORK

Section 23 05 00 - Common Work Results for HVAC

Section 23 11 00 - Facility Fuel Piping

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI Z223.1 National Fuel Gas Code

NFPA 70 National Electric Code

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Submit make-up air heating unit shop drawings including the following information:

- Complete fan performance curves for Supply Air, with system operating conditions indicated, as tested on an AMCA Certified Chamber.
- Sound performance data for Supply Air, as tested on an AMCA Certified chamber.
- Motor ratings, electrical characteristics and motor and fan accessories.
- Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
- Estimated gross weight of each installed unit.
- Installation, Operating and Maintenance manual (IOM) for each model.
- Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.
- Remote Panel description to include all functions.
- Color chart including a palette of available standard paint finishes.

Submit manufacturer's installation and start-up instructions, maintenance data, troubleshooting guide, parts lists, controls and accessories.

At substantial completion, submit warranty certificate and copy of start-up report.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

DELIVERY, STORAGE AND HANDLING

Comply with manufacturer's instructions for storing, rigging, unloading, and transporting units. Protect units from physical damage. Leave factory-shipping covers in place until installation.

Ship units to jobsite fully assembled

WARRANTY

Provide a one year parts and labor warranty on the entire unit beginning upon substantial completion of project.

COORDINATION

Coordinate size and location of all building penetrations required for installation of each MAU and associated ducting, plumbing and electrical systems.

Coordinate sequencing of construction of associated plumbing, HVAC and electrical supply [roofing contractor].

EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Filters: 2 sets of MERV 13 disposable filters for each unit.

One set of fan belts.

PART 2 – PRODUCTS

MAKE-UP AIR HEATING UNITS

Manufacturers: Captive-Aire, Greenheck, Rapid, Thermotek, Rupp or approved equal.

MANUFACTURED UNITS

Unit with Integral Heating shall be fully assembled at the factory and consist of an insulated metal cabinet, motorized intake dampers, sensors, freeze protection, filter assembly for intake air, supply air blower assembly and an electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

CABINET

Materials: Formed, double wall insulated metal cabinet fabricated to permit access to internal components for maintenance. Underside of unit shall have formed metal panels covering base panel insulation

- Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. [Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel]. Base rail is 12 gauge, galvanized (G90) steel
- Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

- Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
- Thickness: 1 inch (25 mm)
- Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested according to ASTM C 411.
- Location and application: Floor of each unit shall be insulated with 1 inch thick rigid fiberglass insulation, covered on one surface with integral aluminum foil. [Full interior coverage of entire cabinet to include walls and roof of unit shall be semi-rigid type and installed between inner and outer shells of all cabinet exterior components when double walls are specified]. [Full interior coverage from “Heating on”] [Full interior coverage from “Cooling on”] [entire unit]
- Access panels: Unit shall be equipped with insulated hinged access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge galvanized G90 steel. Removable access panels shall incorporate a formed drip edge.
- Supply Air blower assembly: Blower assembly consists of an electric motor and a belt driven, double width, and double inlet forward curve blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on minimum 1.125 inch thick neoprene vibration isolators.
- Control center / connections: unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.
- Direct Gas-Fired Furnace:
- Shall be factory assembled, piped and wired direct gas-fired system of 92% efficiency with a draw through design and field adjustable burner baffles with a direct spark ignition system.
- Shall have a cast aluminum burner manifold and stainless steel mixing plates. No air from the inside space shall be allowed to pass across the burner at any time. Flame rectification shall be provided by an ultra-violet scanner. A flame safeguard display shall be included. Burner control shall have a digital coded fault indicator capable of storing the last five faults.
- Shall be equipped for operation on natural gas with a maximum rated inlet gas pressure of 2 psi. Gas pressure regulator shall be provided.

- Shall have fault sensors to provide fault conditions to optional digital controller or building controls.
- Shall have temperature control provided by an electronic 25:1 turndown-ratio modulating discharge air sensor. Amplifier to include a low fire time delay potentiometer, sensitivity potentiometer, minimum discharge air temperature potentiometer and maximum discharge temperature potentiometer.
- Shall include the following safety controls:
 - Manual Reset, High Limit Switch: Main gas valve closes if high-limit temperature is exceeded.
 - Dual safety shutoff valves shall be provided that do not exceed 120 VAC control signals.
 - High and low Gas Pressure Switch: Main gas valve closes if high or low pressure switch faults.
 - FM global requirements: Include high and low gas pressure switches and visual indication gas valves.
 - Two hydraulic proof of close valves(s) shall be included.
 - A gas vent line shall be included that vents gas from between the safety shutoff valves.
 - Visual indication: Clear visual signal demonstrating the position of the main gas safety shutoff valves.
 - Motorized dampers / Intake Air: Motorized damper of insulated low leakage type shall be factory installed.

BLOWER

- Blower section construction, Supply Air: Belt drive motor and blower shall be assembled onto a minimum 14 gauge galvanized steel platform and must have neoprene vibration isolation devices, minimum of 1 – 1/8 inches thick.
- Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
- Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.
- Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.
- Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established according to AMCA 210, “Laboratory Methods of Testing Fans for Rating.”

MOTORS

- General: Blower motors greater than ¾ horsepower shall be “NEMA Premium™” unless otherwise indicated. Compliance with EPart minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives

shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley. Comply with requirements in Division 23 05 13, matched with fan load.

- Motors shall be 60 cycle, 1 phase 230 volts.

UNIT CONTROLS

The unit shall be constructed so that it can function as a stand-alone heating and make-up air system controlled by factory-supplied controllers, thermostats and sensors. This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

FILTERS

Unit shall have 2" thick MERV 13 disposable pleated filters] located in the outdoor air intake and shall be accessible from the exterior of the unit.

PART 3 – EXECUTION

EXAMINATION

- Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
- Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
- Proceed with installation only after all unsatisfactory conditions have been corrected.

INSTALLATION

Installation shall be accomplished according to these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

CONNECTIONS

- In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
- Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.
- Duct installation and connection requirements are specified in Division 23 of this document.
- Electrical installation requirements are specified in Division 26 of this document.

FIELD QUALITY CONTROL

Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and

pipng connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

START-UP SERVICE

Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Verify water source for compliance with manufacturer's requirements for flow and temperature. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

DEMONSTRATION AND TRAINING

Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION 23 73 33.16

SECTION 23 83 34 – IN-FLOOR HOT WATER RADIANT SYSTEMS AND EQUIPMENT

PART 1 – GENERAL

SCOPE

RELATED WORK

Section 23 05 15 - Piping Specialties

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM F876 Standard Specification for Crosslinked Polyethylene Tubing (PEX)

ASTM B75 Seamless Copper Tube

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Provide manufacturer's literature for tubing, manifolds, valves, and all accessories provided for the project.

Provide a "job-specific" parts list of all parts proposed for this project.

RECORD DRAWINGS

Provide as-built drawings show precisely document location and spacing of all tubing concealed from future view.

PART 2 – PRODUCTS

PLASTIC PIPE AND FITTINGS

PEX-a (Engle-method Crosslinked Polyethylene) Piping: ASTM 876 with oxygen-diffusion barrier that meets DIN 4726.

Basis-of-Design Product: Subject to compliance with requirements, provide **Uponor Wirsbo hePEX** or a comparable product.

PEX-a Fittings, Elbows and Tees (1/2 inch through 2 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:

- UNS No. C69300 Lead-free (LF) Brass
- 20% glass-filled polysulfone as specified in ASTM D6394
- Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D6394
- Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D6394

- Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D6394
- Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked “F1960”.

PEX-a Fittings (2½ inch through 4 inch nominal pipe size): SDR9 compression type fitting consisting of a double O-ring insert with a compression sleeve tightened around the pipe and insert.

TRANSITION FITTINGS

Plastic-to-Metal Transition Fittings:

- Manufacturers: Provide fittings from the same manufacturer of the piping.
- Threaded Brass to PEX-a Transition: one-piece brass fitting with male or female threaded adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- Brass Sweat to PEX-a Transition: one-piece brass fitting with sweat adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

TRANSITION UNIONS

Plastic-to-Metal Transition Unions:

- Manufacturers: Provide fittings from the same manufacturer of the piping.
- Threaded Brass to PEX-a Union: one-piece brass fitting with male or female threaded adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- Brass Sweat to PEX-a Union: one-piece brass fitting with sweat adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

PART 3 – EXECUTION

PIPING APPLICATIONS

Hot-water heating piping, aboveground (2 inch and below) shall be the following:

- PEX-a piping, with F1960 cold-expansion fittings.

Hot-water heating piping installed below ground and within slabs shall be any of the following:

- 2 inch and below – Sleeved PEX-a piping with engineered polymer (EP) polyphenylsulfone F1960 cold-expansion fittings. Use the fewest possible joints and install per manufacturer’s recommendations.
- 1 inch through 2 inch – Pre-insulated PEX-a piping with multi-layer, closed-closed cell PEX-foam insulation and a corrugated HDPE jacket with engineered polymer (EP) polyphenylsulfone F1960 cold-expansion fittings. Use the fewest possible joints and install per manufacturer’s recommendations.

Condenser-water piping, aboveground (2½ inch through 4 inch) shall be the following:

- PEX-a piping, with compression fittings.

Condenser-water piping installed below ground and within slabs shall be any of the following:

- 2 inch and below – Sleeved PEX-a piping with engineered polymer (EP) polyphenylsulfone F1960 cold-expansion fittings. Use the fewest possible joints and install per manufacturer's recommendations.
- 1 inch through 2 inch – Pre-insulated PEX-a piping with multi-layer, closed-closed cell PEX-foam insulation and a corrugated HDPE jacket with engineered polymer (EP) polyphenylsulfone F1960 cold-expansion fittings. Use the fewest possible joints and install per manufacturer's recommendations.

PIPING INSTALLATIONS

Install PEX-a tubing according to manufacturer's recommendations.

HANGERS AND SUPPORTS

PEX-a Piping Hanger Spacing: Install hangers for PEX-a piping with the following maximum spacing:

- 1 inch and below: Maximum span, 32 inches.
- 1 1/4 inch and above: Maximum span, 48 inches.

PEX-a Piping Hanger Spacing with PEX-a Support Channel: Install hangers for PEX-a piping with horizontal support channel according to local jurisdiction and manufacturer's recommendations, with the following maximum spacing:

- Maximum span, 8 feet.

PEX-a Riser Supports: Install CTS riser clamps at the base of each floor and at the top of every other floor. Install mid-story guides between each floor.

PIPE JOINT CONSTRUCTION

PEX-a Connections: Install per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for F1960 connections.

CHEMICAL TREATMENT

(Refer to Specification Section 23 25 00.)

FIELD QUALITY CONTROL

Do not expose PEX piping to direct sunlight for more than 30 days. If construction delays are encountered, provide cover to portions of piping exposed to direct sunlight.

WARRANTY

PEX-a manufacturer system warranty shall cover tubing for a duration of 30 years from the date of installation.

END OF SECTION 23 83 34

END OF DIVISION 23 – HVAC

44. SWEF Building, Electrical, Item SPV.0105.104.

A Description

This item consists of the electrical work for the SWEF building. The work shall be according to the applicable plans and the following specifications.

B (Vacant)

C (Vacant)

D Method of Measurement

The department will measure SWEF Building, Electrical, completed in accordance to the contract and accepted, as a single complete unit of work.

E Basis of Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.104	SWEF 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.

DIVISION 26 – ELECTRICAL

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

The electrical work included in all other divisions is the responsibility of the contractor performing the division 26 work unless noted otherwise.

1.01 SCOPE

A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 REFERENCE STANDARDS

A. 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.

1.04 REGULATORY REQUIREMENTS

A. All work and materials are to conform in every detail to applicable rules and requirements of the Wisconsin State Electrical Code (SPS 316), the National Electrical Code (NFPA 70), the National Electrical Safety Code, and present manufacturing standards (including NEMA).

B. All Division 26 work shall be done under the direction of a currently certified State of Wisconsin Certified Master Electrician.

1.05 QUALITY ASSURANCE

A. 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.

B. Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

C. 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, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, shall be so labeled.

1.06 PROTECTION OF FINISHED SURFACES

A. Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

1.07 APPROVED ELECTRICAL TESTING LABORATORIES

A. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:

1. Underwriters Laboratories Inc.
2. Electrical Testing Laboratories, Inc.

1.08 SLEEVES AND OPENINGS

A. The Electrical contractor shall provide and install all conduit sleeves as required for line voltage and low voltage system wiring.

1.09 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, etc. and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.10 INTENT

A. 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.

B. 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 project. Refer to the General Conditions of the Contract for further clarification.

C. It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. All sizes as given are minimum except as noted.

E. Materials shall be new, first class, and workmanlike, and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

F. 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.

1.11 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the engineer to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.12 SUBMITTALS – (Electronically)

A. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

B. On request the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

C. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

D. The submittals must be approved before fabrication is authorized.

E. Submit sufficient quantities of submittals to allow the following distribution:

Operating and Maintenance Manuals	2 copies
User agency	1 copy
A/E	1 copy

1.13 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections.

C. Tools, materials and equipment shall be confined to specific areas.

1.14 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate user agency's occupancy requirements. During the construction period coordinate electrical schedule and operations with General Contractor.

1.15 WORK BY OTHER TRADES

A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.

B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.16 OFFSITE STORAGE (Not Anticipated)

1.17 CERTIFICATES AND INSPECTIONS

A. Obtain and pay for all required Municipal, and State installation inspections and/or reviews.

B. This contractor is responsible for coordination of electrical inspections.

1.18 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

B. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. Manufacturer's wiring diagrams for electrically powered equipment.

1.19 RECORD DRAWINGS

A. The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.

B. The A/E will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.

C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.

D. At completion of the project, the Contractor shall submit the marked-up record drawings to the A/E prior to final payment.

PART 2 - PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-in Ceilings: Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under other divisions are sufficient; no additional access provisions are required unless specifically indicated.

B. Concealed Spline Ceilings: Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under other divisions.

C. Metal Pan Ceilings: Removable sections of ceiling tile held in position by pressure fit will be provided under other divisions.

D. Plaster Walls and Ceilings: 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.02 IDENTIFICATION

A. See Electrical section 26 05 53 – Identification for Electrical Systems.

2.03 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:

1. Manufacturers: 3M, STI/SpecSeal, Tremco, Hilti or approved equal. All firestopping systems shall be by the same manufacturer.

2. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
3. Product: Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Safety and Professional Services.
4. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
5. Contractor shall use firestop putty, caulk sealant, intumescent wrap strips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

B. NON-RATED PENETRATIONS:

1. Conduit 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 conduit and the cored opening or water-stop type wall sleeve.
2. Conduit and Cable Tray Penetrations: At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL

- A. Perform all excavation and backfill work to accomplish indicated electrical systems.

3.02 CONCRETE WORK

- A. The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

3.03 CUTTING AND PATCHING

A. Refer to Division 1, General Requirements, Cutting and Patching.

3.04 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

3.05 COORDINATION

A. The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.

C. Coordinate all work with other contractors 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.

3.06 SLEEVES

A. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.

B. In wet area floor penetrations, the top of the sleeve shall be 2 inches above the adjacent floor. In existing wet area floor areas, core drill sleeve openings large enough to insert a schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers, and similar waterside equipment.

3.07 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Penetrations:

1. Install approved product according to the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

B. Non-Rated Surfaces:

1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
2. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, according to the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
4. At interior partitions, conduit penetrations are required to be sealed for all tele/data/com rooms and similar spaces. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.08 HOUSEKEEPING AND CLEAN UP

- #### **A.**
- The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION 26 05 00

SECTION 26 05 04 – CLEANING, INSPECTION AND TESTING OF ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes the required cleaning, repair, adjustment, calibration, maintenance and testing of electrical equipment, as specified herein. This applies only to new electrical equipment being furnished, modified, worked on or serviced by this contractor for this project. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

PART 2 - PRODUCTS

2.01 Not Used.

PART 3 - EXECUTION

3.01 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

A. Inspect for physical damage and abnormal mechanical and electrical conditions.

B. Any item found to be out of tolerance, or in any other way defective as a result of the required inspection or testing, shall be reported to the A/E. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.

C. Compare equipment nameplate information with the latest single line diagram and report any discrepancies.

D. Verify proper auxiliary device operation and indicators.

E. Check tightness of accessible bolted electrical joints. Use torque wrench method.

F. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.

G. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.

H. Clean All Equipment:

1. Vacuum inside of panelboards, switchgear, comm/data, security panel, etc.
2. Loosen attached particles and vacuum them away.
3. Re-vacuum inside surfaces as directed by the General Contractors Construction Representative or Inspector.

I. Inspect equipment anchorage.

J. Inspect equipment and bus alignment.

K. Check all heater elements for operation and control.

L. Lubricate nonelectrical equipment per manufacturer's recommendations.

3.02 GROUNDING SYSTEMS

A. Inspect the ground system for adequate termination at all devices.

3.03 CABLES

A. 600 Volt cable:

1. Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections.
2. Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor terminations to manufacturer's recommendations.
3. Perform a 1000 vdc megger test on all secondary cables from the substation transformers to the secondary switchboards and on all switchboard feeders.

3.04 PANELBOARDS

A. Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

3.05 LIGHT FIXTURES

A. Check the bonding and proper lamping. Verify that recessed fixtures are installed with hold down clips. Confirm operation of the fixture with the proper switch or sensor.

3.06 OCCUPANCY SENSORS

Confirm operation of the sensor per the manufacturers spec.

3.07 GENERATORS

- A. Run the generator through the standard tests as recommended by the manufacturer including the load bank test. Test the automatic start circuits and run the full diagnostic tests. Verify the fuel and the tank. Check for fuel and coolant leaks.
- B. Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption.
- C. After the generator has cooled down from the four hour test, shut it down and then simulate a power failure including operation of the transfer switch, automatic cycle, and automatic shutdown and return to normal.

3.08 AUTOMATIC TRANSFER SWITCHES

- A. Coordinate with the generator and the subsequent tests.
- B. Check the automatic transfer switches and automatic start circuits for proper function.

3.09 MOTOR STARTERS AND MOTOR CONTROL CENTERS

- A. Verify the control circuits. Confirm the fusing and the grounding of the control transformers. Torque all of the connections. Confirm the overload elements and the circuit breakers (fuse) for proper sizing. Verify all grounding. Operate and test each motor starter for proper operation.

END OF SECTION 26 05 04

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
2. Section 26 05 53 – Identification for Electrical Systems.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code

1.04 SUBMITTALS

A. Submit product data: Provide for each cable assembly type.

B. Submit shop drawings for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.

1.05 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
- B. All conductors shall be copper. Aluminum conductors not allowed for this project.
- C. Insulation shall have a 600 volt rating.
- D. All conductors shall be stranded.
 - 1. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.02 BUILDING WIRE

- A. Description: Single conductor insulated wire 90 degree C.
- B. Insulation: Type THHN/THWN-2, XHHW-2 insulation.

2.03 SERVICE ENTRANCE CONDUCTORS

- A. Description: Single conductor or multi-conductor insulated wire. 90 degree C sized at the 75 degree C table.
- B. Insulation: Type USE-2, XHHW-2 insulation for service entrance conductors routed from exterior source to exterior termination location.
Type XHHW-2 insulation for services entrance conductors routed from exterior source to interior termination location.

2.04 VARIABLE FREQUENCY DRIVE (VFD) WIRE

- A. All power wiring from the VFD output to the motor shall be type XHHW-2 insulation, single conductor wire.

2.05 ABOVE GROUND WIRE FOR EXTERIOR WORK

- A. Description: Single conductor insulated wire, 90 degree C.
- B. Insulation: Type THHN/THWN-2, XHHW-2 insulation.

2.06 UNDERGROUND WIRE FOR EXTERIOR WORK

- A. Description: Stranded single or multiple conductor insulated wire, 90 degree C.
- B. Insulation: Type USE-2, XHHW-2, RHW-2 insulation.
- C. This wiring shall be used in all underground feeder and branch circuit applications, except THHN/THWN-2 is permitted when run in a concrete-encased ductbank.

2.07 WIRING CONNECTORS

- A. Split Bolt Connectors: Not acceptable.
- B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment terminals. Not approved for splicing.
- C. Twist Type Wire Connectors: Solderless twist type spring connector (wire-nut) with insulating cover for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller. The manufacturer's wire fill capacity must be followed.
- D. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations. Gel filled twist type connectors can be used for copper conductor sizes 6 AWG and smaller for site lighting applications. The manufacturer's wire fill capacity must be followed.
- E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.
- F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps. Connector must be installed with a crimper tool listed for use with the manufacturer and type of compression connector.
- G. Insulation Piercing Connectors: Molded insulated body, copper teeth, wrench tightened, UL 486B Listed. May be used only for connection of a tap conductor in run and tap type applications when main conductor is 8 AWG and larger.

PART 3 - EXECUTION

3.01 GENERAL WIRING METHODS

- A. All wire and cable shall be installed in conduit.
- B. Do not use wire smaller than 12 AWG for power and lighting circuits.

- C. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductors 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).
- D. Make conductor lengths for parallel conductors equal.
- E. Splice only in junction or outlet boxes.
- F. No conductor less than 10 AWG shall be installed in exterior underground conduit.
- G. Identify ALL low voltage wire, 600V and lower, per section 26 05 53.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3.02 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use Listed water or silicone based wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary. Wax based lubricants are not allowed. Pulling lubricant is not required for low friction type products where the cable manufacturer recommends that cables be pulled without lube.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.
- E. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.
- F. In high ambient spaces, mechanical rooms, utility rooms and exterior exposed conduit, 90 degree C conductors shall be utilized.

3.03 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.

- C. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.
- D. Use solderless twist type spring connectors (wire nuts) with insulating covers for wire splices and taps, 10 AWG and smaller.
- E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of the wiring.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.04 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 26 05 04.

3.05 WIRE COLOR

- A. General:

- 1. Solid colored insulation is required for all THHN/THWN-2 wire. For other wire types use colored wire or identify wire with colored tape at all terminals, splices and boxes. Wire shall be colored as indicated below.

- 2. In new facilities, use black and red for single phase circuits at 120/240 volts, use Phase A black, Phase B red Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.

- 3. All switch legs shall be the same color as their associated circuit. Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.

- B. Neutral Conductors: White for 120/240V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with a different (tracer) stripe.

- C. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.

- D. Feeder Circuit Conductors: Each phase shall be uniquely color coded.

E. Ground Conductors: Green colored insulation for THHN/THWN-2 wire. For other wire types use green colored wire or identify wire with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, contractor shall provide green with yellow tracer.

3.06 BRANCH CIRCUITS

A. The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All single-phase branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

3.07 EMERGENCY CIRCUITS

A. All Emergency, Legally Required Standby and Optional Standby system wiring shall be installed in separate raceways after their associated transfer switches. The wiring shall be separate from each other and from all normal system wiring.

B. All emergency wiring serving NEC 700 loads, requiring minimum 1 hour fire rating shall comply with NEC 700.9(D)(1).

C. All generator control conductors installed between transfer equipment and the emergency generator serving NEC article 695 and/ or NEC article 700 associated loads, shall be kept entirely independent of all other wiring and shall meet the conditions of NEC article 700.9(D)(1).

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes grounding electrodes and conductors, equipment grounding conductors, and bonding. Included are the following topics:

B. All hardware, cables and related termination and support hardware shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in this and related sections.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 REFERENCES

1. NFPA 70 - National Electrical Code
2. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems
3. UL 467 Electrical Grounding and Bonding Equipment
4. IEEE 837 - IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
5. ANSI J-STD-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
6. TIA/EIA-606-A - Administration Standard for Commercial Telecommunications Infrastructure

1.04 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance:

1. Equipment Rated 500 KVA and Less: 10 ohms maximum at building service entrance.
2. Equipment Rated 500 to 1000 KVA: 5 ohms maximum at building service entrance.
3. Equipment Rated more than 1000 KVA: 3 ohms building service entrance.
4. Communications Busbars: 5 ohms maximum.

B. Testing of grounding system resistance is to be witnessed by the A/E, electrical inspector or Field Representative. Provide test report of grounding system resistance in final O&M manuals.

1.05 SUBMITTALS

- A. Product Data: Provide data for grounding electrodes and connections.
- B. Test Reports: Indicate overall resistance to ground [and resistance of each electrode].
- C. Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

1.06 PROJECT RECORD DOCUMENTS

- A. Accurately record locations of all ground rods and other grounding electrodes.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 3/4 inch (19 mm) minimum.
- C. Length: 10 feet (3.5 m) minimum. Rod shall be driven at least 9' 6" deep.

2.02 CONCRETE-ENCASED GROUNDING ELECTRODE

- A. Fabricate per NFPA 70, Article 250.52 (A)(3) using 20 feet (6m) of bare copper wire not smaller than #4 AWG. If concrete foundation is less than 20 feet (6m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts.

2.03 MECHANICAL CONNECTORS

- A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are NOT allowed. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray.

C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.04 COMPRESSION CONNECTORS

A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.

B. Each connector shall be factory filled with an oxide-inhibiting compound.

C. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

E. The installation of the connectors shall be made with a compression tool and die system, as recommended by the manufacturer of the connectors, and shall be irreversible.

F. Pre-crimping of the ground rod is required for all irreversible compression connections to a ground rod.

G. Terminal lug for communication system grounding shall be compression type and conform to the following:

1. Material: Tin Plated Copper (aluminum not permitted).
2. Wire Size: to match conductor
3. Number of Stud Holes: 2
4. Stud Hole Size: 3/8"
5. Bolt Hole Spacing: per ANSI Joint Standard J-STD-607-A
6. Tongue Angle: Straight

2.05 EXOTHERMIC CONNECTIONS

A. As manufactured by Cadweld or similar.

2.06 CONDUCTORS

A. Material: Stranded copper (aluminum not permitted).

B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

- C. Foundation Electrodes: As shown on drawings.
- D. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used at the same facility.
- E. Conductors for Telecommunications shall be as follows:
 - 1. Telecommunications Bonding Conductor (TMGB to Service Ground): No. 3/0 minimum or as shown on drawings.
 - 2. Telecommunications Bonding Backbone (TBB; TMGB to TGB): No. 3/0 minimum or as shown on drawings.
 - 3. Telecommunications Grounding Equalizer (GE): No. 3/0 minimum or as shown on drawings.
 - 4. Bonding Conductors shall be insulated with a Green Jacket or jacket marked with Green Tape or labeled per NEC Guidelines

2.07 BUS/BUSBAR

- A. Material: Copper (aluminum not permitted).
- B. Size: All Power systems: 1/4" X 2", length as needed.
 - 1. Telecommunications Main Ground Busbar (TMGB): 1/4" x 4" x 12" long (minimum).
 - 2. Telecommunications Grounding Busbar: Include with equipment rack.
- C. Busbars for Telecommunications shall:
 - 1. Be pre-drilled to accommodate two-hole lugs.
 - 2. 3/8" stud hole size; hole spacing per ANSI J-STD-607-A.
 - 3. Incorporate insulators and stand-off brackets that electrically isolate busbar from mounting surface.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 GENERAL

- A. Install Products according to manufacturer's instructions.

- B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
- D. Attach grounds permanently before permanent building service is energized.
- E. Terminate each grounding conductor on its own terminal lug. Sharing a single lug by multiple conductors is not allowed.
- F. All grounding electrode conductors and individual grounding conductors shall be installed in PVC conduit, in exposed locations.

3.03 LESS THAN 600 VOLT ELECTRICAL SYSTEM GROUNDING

- A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building. Use effectively grounded metal frame of the building.
- B. Provide code sized copper grounding electrode conductor from secondary Main Distribution Panel ground bus, each separately derived system neutral, secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Provide bonding jumper around water meter.
- C. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each device to the respective enclosure.
- D. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

3.04 COMMUNICATION SYSTEM GROUNDING

- A. Grounding and Bonding System for Communications shall be an isolated grounding system with a single ground point. That ground point is to be the common grounding electrode system at the building electrical service entrance.
- B. The system shall be compliant with ANSI J-STD-607-B with the exception that the ground cable shall not be bonded to building steel except at the electrical service entrance.
- C. Provide Grounding Busbar for Telecommunications at Telecommunications Room #116. Coordinate Busbar location(s) and conductor routing per drawings with Division 27 contractor.

D. Provide Telecommunications Bonding Conductor from Telecommunications Main Grounding Busbar (TMGB) at the Communications Entrance Facility to building common grounding electrode system. Attach grounding conductor to building steel as allowed only at the main electrical service entrance.

E. Provide Telecommunications Bonding from the Main Grounding Bar to Telecommunications Grounding Busbar at each Telecommunication equipment rack.

3.05 FIELD QUALITY CONTROL

- Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.06 IDENTIFICATION AND LABELING

A. Label Grounds at point of termination.

B. Label the connections from the Telecommunications Bonding Backbone conductor to the Telecommunications Main Grounding Busbar and the Telecommunications Grounding Busbar. The label shall be plastic and include the following:

IF THIS CONNECTOR OR
CABLE IS LOOSE OR MUST BE
REMOVED, PLEASE CALL THE
BUILDING
TELECOMMUNICATIONS
MANAGER.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes conduit and equipment supports, straps, clamps, steel channel, etc., and fastening hardware for supporting electrical work. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITTALS

A. Product Data: Provide data for support channel.

1.04 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.

B. Hardware: Corrosion resistant.

C. Minimum sized threaded rod for supports shall be 3/8" for trapezes and single conduits 1-1/4" and larger, and 1/4" for single conduits 1" and smaller.

D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid steel conduit is installed on the interior or exterior surface of any exterior building wall.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fasten hanger rods, conduit clamps, outlet, junction, and pull boxes to building structure using pre-cast insert system, preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only).

- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in anchors are used, they must be removable type anchors.
- C. Powder-actuated fasteners and plastic wall anchors are not permitted. Compressed-air power-actuated fasteners may ONLY be used for the installation of separate ceiling wires required for support of conduits and aircraft cable hung light fixtures.
- D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.
- E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.
- F. Do not drill structural steel members unless approved by A/E.
- G. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5-inch (89 mm) concrete pads.
- I. Install surface-mounted cabinets and panelboards with a minimum of four anchors. At all cabinet and panelboard locations on concrete or concrete block walls, and at ALL locations below grade, provide steel channel supports to stand cabinet one inch (25 mm) off wall (7/8" Uni-strut or 3/4" painted, fire-retardant plywood is acceptable). In above-grade equipment rooms that have drywall walls, the cabinets and panelboards may be mounted to the drywall if backing is provided in the stud walls behind the equipment.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes raceways and boxes for electrical, communications and other low voltage systems including conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, wall and ceiling outlet boxes, and junction boxes. Included are the following topics:

1.02 RELATED WORK

- A. Applicable provisions of Division 1 govern work under this section.
1. Section 26 05 29 – Hangers and Supports for Electrical Systems.
 2. Section 26 27 02 – Equipment Wiring Systems.
 3. Section 26 27 26 – Wiring Devices.
 4. Section 27 00 00 – Communications Cable and Equipment.

1.03 SUBMITTALS

- A. Surface Raceway System - submit product data and catalog sheets for all components.
- B. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 - PRODUCTS

2.01 RIGID METAL CONDUIT (RMC) AND FITTINGS

- A. Conduit: Heavy wall threaded, galvanized steel, schedule 40.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.
- C. Fittings and Conduit Bodies: Threaded type, material to match conduit. The sleeves shall extend beyond the fitting or coupling a distance equal to the pipe outside steel diameter or two inches (50 mm) whichever is greater.

2.02 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

- A. Conduit: Galvanized steel, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.03 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Conduit: Steel, galvanized tubing.
- B. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.
- C. Conduit Bodies: All steel threaded conduit bodies.

2.03 FLEXIBLE METAL CONDUIT (FMC) AND FITTINGS

- A. Conduit: steel, galvanized, spiral strip.
- B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 26 51 13).

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) AND FITTINGS

- A. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.05 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) AND FITTINGS

- A. Conduit: Rigid non-metallic conduit, Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90⁰ C conductors.
- B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.06 CONDUIT SUPPORTS

- A. See section 26 05 29.

2.07 AUXILIARY GUTTERS (WIREWAYS)

- A. Description: General purpose type wireway without knockouts.
- B. Size: As required to meet project conditions.
- C. Cover: Hinged cover with full gasketing.
- D. Connector: hinged cover.

- E. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
- F. Finish: Rust inhibiting primer coat with gray enamel finish.

2.08 PULL AND JUNCTION BOXES

- A. Interior Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.
- B. Interior Sheet Metal Boxes Larger Than 12 Inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover.
- C. Exterior Boxes and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron, PVC and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Quazite Handholes with weatherproof cover of non-skid finish shall be used for underground installations. Cover shall identify system serviced.
- E. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.
- F. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.
- G. Wireways shall not be used in lieu of junction boxes.

2.09 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.
- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
- C. Concrete Ceiling Boxes: Concrete type.
- D. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.

2.10 GENERAL

- A. All steel fittings and conduit bodies shall be galvanized.
- B. No cast metal, or split-gland type fittings permitted.
- C. Mogul-type condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.

- D. All conduit covers must be fastened to the conduit body with screws and be of the same manufacture.
- E. Wireways, gutters and c-conduits shall not be used in lieu of pull boxes and conduits.
- F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

PART 3 - EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. EMT is permitted to be used in sizes 4" (50 mm) and smaller for power and low-voltage systems.
- B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch (16 mm) minimum except all homerun conduits shall be 3/4" (21 mm), or as specified elsewhere. Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.
- C. Minimum size for raceway for communications, control, security, signal, video and other low-voltage applications shall be 3/4 inch, unless otherwise noted on drawings.
- D. Provide one raceway from each communications outlet box to above accessible ceiling to cable tray.
- E. Arrange conduit to maintain headroom and present a neat appearance.
- F. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- G. Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- H. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
- I. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

- J. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
- K. Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.
- L. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.
- M. In general, all conduit shall be concealed except where noted on the drawings or approved by the Architect/Engineer.
- N. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
- O. For indoor conduits, no continuous conduit run shall exceed 100 feet (30 meters) without a junction box.
- P. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.02 CONDUIT INSTALLATION

- A. cut conduit square; de-burr cut ends.
- B. Conduit shall not be fastened to the corrugated metal roof deck.
- C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.
- E. Terminate all conduit (except for terminations into conduit bodies) using conduit hubs, or connectors with one locknut, or shall use double locknuts (one each side of box wall) and insulated bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 26 05 26 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.
- F. Install no more than the equivalent of:
 - 1. Three 90 degree bends between boxes for electrical systems.
 - 2. Two 90 degree bends between boxes for communications and other low voltage systems.
- G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.

- H. Bend conduit according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.
- I. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
- J. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
- K. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.
- L. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.
- M. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
- N. Route conduit through roof openings for piping and ductwork where possible.
- O. Where communication cabling is to be installed in conduit to the wiring hub (e.g. Telcom Room), multiple conduits may be consolidated into fewer, larger conduits. Capacity of shared conduits shall equal the capacity of the individual conduits unless otherwise noted.
- P. Use U.L. listed metallic grounding clamps when terminating conduit to cable tray.
- Q. Provide conduit and junction boxes as required for AUDIO VISUAL SYSTEMS.
- R. Ground and bond conduit under provisions of Section 26 05 26.
- S. Conduit is not permitted in any slab topping of two inches (50 mm) or less.
- T. Maximum Size Conduit in Slabs Above Grade: 3/4 inch (19 mm). Do not route conduits to cross each other in slabs above grade.
- U. Identify conduit under provisions of Section 26 05 53.
- V. All conduit installed underground exterior to building shall be buried a minimum of 24" below finished grade, whether or not the conduit is concrete encased.

W. Clean PVC conduit with solvent, and dry before application of glue. The temperature rating of glue/cement shall match weather condition. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturer's recommendations.

X. Conduit other than that specified below for specific applications shall not be used.

1. Underground Installations Within Five Feet (1.5 m) of Foundation Wall: Schedule 40 PVC conduit unless noted otherwise.
2. Underground Installations More than Five Feet (1.5 m) From Foundation Wall: Schedule 40 PVC conduit.
3. Under Slab on Grade Installations: Schedule 40 PVC conduit.
4. Exposed Outdoor Locations: Schedule 80/40 PVC conduit.
5. Concealed in Concrete Walls: Schedule 40 PVC conduit.
6. Concealed in Block Walls: Electrical metallic tubing, Schedule 40 PVC conduit.
7. Within Concrete Slab: Schedule 40 PVC conduit.
8. Wet Interior Locations: Schedule 40 PVC conduit.
9. Concealed Dry Interior Locations: Electrical metallic tubing.
10. Exposed Dry Interior Locations: Electrical metallic tubing.
11. Motor and equipment connections: Liquidtight flexible metal conduit (LFMC) (all locations). Minimum length shall be one foot (300 mm), maximum length shall be three feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
12. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" (10 mm) minimum diameter and six foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

3.03 AUXILIARY GUTTERS (WIREWAYS) INSTALLATION

A. Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure.

- B. Gasket each joint in oil-tight gutter.
- C. Mount rain-tight gutter in horizontal position only.
- D. Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.

3.04 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of outlets in offices and work areas prior to rough-in.
- C. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
- D. Conduit and boxes shall not be fastened to the metal roof deck. If conduit and boxes are required to be located and installed on roof decks, the conduit and boxes are required to be spaced minimum 1-5/8" off the lowest part of the metal roof decking material, per NEC 300.4 (E).
- E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
- F. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.
- G. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.
- H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors. Boxes must be installed within 12" from edge of the access door.
- I. Locate and install to maintain headroom and to present a neat appearance.
- J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.05 PULL AND JUNCTION BOX INSTALLATION

- A. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8 inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit, minimum junction box size shall be 4 11/16" by 2-1/8" deep.
- B. Where used with raceway(s) of larger than 1 1/4" trade size or larger, pull box shall be sized as follows unless otherwise noted on the drawings:
- C. For straight pull through, have a length of at least 8-times trade-size diameter of largest raceway;
 - 1. For angle and U pulls:
 - a. Have a distance between each raceway entry inside box and opposite wall of box of at least 6-times trade-size diameter of largest raceway, this distance being increased by sum of trade-size diameters of other raceways on same wall of box; and
 - b. Have a distance between nearest edges of each raceway entry enclosing same conductor of at least six times trade-size diameter of raceway; or six times trade-size diameter of larger raceway if they are of different sizes.
- D. For a raceway entering wall of a pull box opposite to a removable cover, have a distance from wall to cover of not less than trade-size diameter of largest raceway plus 6-times diameter of largest conductor.
- E. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.
- F. Provide Pull and Junction boxes for communications and other low voltage applications (a) in any section of conduit longer than 100 feet, (b) where there are bends totaling more than 180 degrees between pull points or pull boxes and (c) wherever there is a reverse bend in run. Locate boxes on straight section of raceway (e.g. do not use boxes in place of raceway bends).
- G. Support pull and junction boxes independent of conduit.

3.06 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch (150 mm) separation, except provide minimum 24 inch (600 mm) separation in acoustic-rated walls.

B. Power:

1. Recessed (1/4" maximum) outlet boxes in masonry, concrete, tile construction, or drywall shall be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes. A single gang box can be used in drywall and masonry, for a single device location, when a single conduit enters box.
2. Shallow 4x4x1-1/2" deep boxes can be used as device boxes for power provided the box and plaster ring is sized for installed device and conductors.

C. Low Voltage:

1. Recessed (1/4" maximum) outlet boxes in masonry, concrete, tile construction or drywall shall be minimum 4 11/16 inch square, 2-1/8" deep with single gang device ring (unless noted otherwise on drawings). Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
2. Provide one conduit from each communications outlet box. Conduit runs between outlet boxes for communications are not allowed. Terminate conduit on cable tray.

D. Provide knockout closures for unused openings.

E. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.

F. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.

G. Install boxes in walls without damaging wall insulation.

H. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

I. Ceiling outlets shall be 4 inch square, minimum 2-1/8 inch (54 mm) deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.

J. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches (150 mm) of recessed luminaire, to be accessible through luminaire ceiling opening.

K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

L. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

M. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

N. Surface wall outlets shall be 4 inch (100 mm) square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.07 AUDIO VISUAL SYSTEMS CONDUIT INSTALLATION

A. Conduit requirements for AV systems cabling may differ from those of other trades. It is important that the electrical contractor become familiar with these specialized requirements. AV systems cabling must be enclosed within continuously grounded ferrous metallic conduit or raceway. PVC conduit is not acceptable. Conduit and raceway is to be furnished and installed by electrical contractor. Conduits containing different wiring classes must maintain minimum separations to minimize interferences from electrical noise. Conduits sizes and quantities shown on bid documents are minimums. Separate conduit runs specified in bid documents may not be combined for any purpose.

END OF SECTION 26 05 33

SECTION 26 05 36 – CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes furnishing of all labor, material, supports and services to install a complete cable tray system as shown and or indicated on the drawings. The cable tray system is defined to include, but not limited to, straight sections of cable tray, bends, tees, elbows, drop-outs, supports and all other related accessories necessary for a complete installation. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1. Section 26 05 29 - Hangers and Supports for Electrical Systems
2. Section 27 00 00 - Communications Cable and Equipment

1.03 REFERENCES

1. ANSI/NFPA 70 - National Electrical Code.
2. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
3. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
4. ASTM A510 - General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
5. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
6. ASTM A580 - Standard Specification for Stainless Steel Wire
7. ASTM B 633 - Specification for Electro-deposited Coatings of Zinc on Iron and Steel
8. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
9. ASTM A653/A653M-00 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process
10. ASTM D769 - Standard Specification for Black Synthetic Iron Oxide
11. NEMA VE 1 - Metal Cable Tray Systems
12. NEMA VE 2 - Metal Cable Tray Installation Guidelines
13. BICSI Telecommunications Distribution Methods Manual (Latest Edition)

1.04 SUBMITTALS

- A. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.
- B. Product Data: Provide data for tray sections, connector assemblies, clamp assemblies, brackets, splice plates, splice bars, grounding clamps, hold-down plates, support hardware, and accessories.
- C. Detailed sketch of proposed method(s) of installation.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

PART 2 - PRODUCTS

2.01 LADDER RACK for TELECOM ROOMS

- A. Refer to specification section 27 00 00 - Communications Cable and Equipment, for Ladder Rack used inside Telecom Rooms. Ladder Rack shall be furnished and installed by the Division 27 contractor inside Telecom Rooms.

2.02 WIRE BASKET CABLE TRAY and COMPONENTS

- A. Description: Continuous, rigid, welded steel wire mesh cable support system.
- B. Material: Carbon steel wire, ASTM A510, Grade 1008. Wire shall be welded, bent and surface treated after manufacture.
- C. Finish: Electro-Plated Zinc Galvanizing per ASTM B633, Type III, SC-1 or Electro-plated yellow zinc dichromate according to ASTM B633 SC2.
- D. Wire diameter shall be 0.195" (5mm) minimum on all mesh sections up to 16 linear inches. Wire diameter shall be 0.234" (6mm) minimum on all mesh sections in excess of 16 linear inches.
- E. Wire Mesh to be welded at all intersections. Each wire end shall be rounded along tray sides for safe handling and to protect cables from damage.
- F. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be T-welded on all tray sizes.
- G. Dimensions:

- H. Mesh Dimension: 2 x 4 inches.
 - 1. Inside Width: 12-inches
- I. Inside Depth: 4 -inches.
- J. Bends/Reducers/Tees/Horizontal and Vertical Offsets: These may be factory manufactured or field fabricated according to manufacturer's instructions.
- K. Provide manufactured "Radius shield" for a smooth inside radius surface.
- L. Support System: To be part of a system incorporating mechanisms for wall installation, trapeze, center support, or under-floor mounting. Supports shall comply with product requirements defined in specification section 26 05 29.
- M. Hardware: Hardware, including splice connectors and support components, shall be furnished by cable tray manufacturer.
- N. Grounding: Assembled tray shall be UL classified as an equipment grounding conductor.

2.03 WARNING LABELS

- A. Engraved or printed nameplates shall include the following or similar language:
 - 1. WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install according to manufacturer's instructions.
- B. Install metallic cable tray according to NEMA VE-1 and VE-2.
- C. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps as required.
- D. All single and multi-conductor cables shall be fastened to the tray at intervals not to exceed four feet (4').
- E. Conduit connections to the tray shall be made with an U.L. approved clamps, manufactured specifically for the purpose.

F. Coordination

1. The Contractor shall coordinate the installation of the cable tray with plumbing and HVAC Contractors so that clearance is maintained between the cable tray and other trades work. This clearance shall be minimum of 1 foot on both sides of the cable tray (one side if wall mounted) and 8 inches on top of the cable tray. Tray shall not restrict removal of ceiling panels nor lighting assemblies. If these conditions cannot be met, this Contractor shall notify the A/E for clarification and direction before proceeding with installation.

2. Do not install cable tray below re-heat coils, traps, etc. In those areas that have no option furnish and install a manufacturer approved cover extending 12" on either side.

G. Clearances

1. Minimum separation distances between communications wires and cables, and any electric light, power, Class 1, or medium power network-powered broadband communications circuit shall comply with NEC Article 800.

2. In addition, to reduce or eliminate EMI, the following minimum separation distances shall be adhered to:

- a. Thirty-nine (39) inches from transformers and motors.
- b. Balanced twisted-pair cabling installed in cable tray shall be separated from fluorescent lamps and associated fixtures by a minimum of 5 inches (125 mm).
- c. Zero pathway separation distance is permitted when the electrically conductive telecommunications cables, the power conductors or both are enclosed in metallic pathways that meet the following conditions:
 - 1) The metallic pathway(s) completely enclose the power conductors and are continuous;
 - 2) The metallic pathway(s) are properly bonded and grounded per ANSI/TIA-607-B; and
 - 3) The walls of the pathway(s) have a minimum thickness 1 mm (0.04 in) nominal if made of steel (1/2" EMT minimum)
 - 4) No separation is required between power and telecommunications cables crossing at right angles.

H. Support

1. No conduit shall be attached to the cable tray except for the conduits that terminate at the cable tray. Cable tray supports can be used to support conduit. Do not use more than 1/2 of the cable tray support for conduit support.

2. Support trays according to Section 26 05 29. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 8 feet (2.5 m) maximum.
3. All of the threaded rod used for the tray support shall be 3/8" diameter for 12" wide tray and 1/2" minimum for tray larger than 12" wide.
4. Where a single Center Support is used for 12" wide tray, threaded rod shall be 1/2".
5. Bolts and nuts shall be installed in all holes of the cable tray splice plates per the manufacturer's instructions for installation.
6. Tray support shall be installed in a trapeze, wall angle, or center support configuration as shown on the plans, outlined in the spec and approved by the engineer. Center support is allowed on 12" wide and less cable tray.
7. Supports shall be formed shape channel trapeze members per section 26 05 29, or formed mounting assemblies that are part of the manufacturer's integrated cable tray system, complete with nuts, bolts, washers, lock washers and tray clamps as required for a complete and finished installation.
8. Submit complete detailed sketch(es) for approval of the actual proposed method(s) of installation.
9. The maximum allowable deviation of the tray, from the level horizontal plane measured across the width of the tray, is one half of one inch (1/2"), with the tray loaded to capacity, as allowed by the NEC.
10. The approval of the installation method does not relieve this contractor from meeting the above deviation requirement. If additional support is needed, as determined by the engineer, this contractor shall furnish and install the additional support at no additional cost to the State.

I. Fittings and Hardware

1. Use manufactured expansion fittings where required at the building expansion joints and as required by the manufacturer.
2. Nuts, bolts, washers, rod, etc. shall be plated.
3. Provide End-of Run Drop-out (4-inch radius; minimum) at terminus of cable tray at equipment room(s) and wherever tray is discontinuous and there is a change in height.

J. Grounding and Bonding

1. Ground and bond cable tray under provisions of Section 26 05 26.
2. Provide electric continuity between tray components. Provide manufacturer's grounding clamps as required. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly if required by the manufacturer. Assembled tray shall be U.L. classified as an equipment grounding conductor.
3. Provide #4 AWG bare stranded copper equipment grounding conductor through entire length of tray. Bond equipment ground conductor to each component, each tray section, and connect to the main building equipment grounding conductor. Equipment grounding conductor is not required in telecommunications applications provided that the tray is U.L. Listed for grounding.
4. Bond cable tray to the telecommunication grounding bar or conductor in each equipment room (#4 AWG minimum).
5. Equipment grounding conductor connections to the tray shall be made using a U.L. listed mechanical connection. Sheet metal or TEK screws shall not be used for grounding. Split bolts may be used for connection to wire-basket type trays.

K. Penetrations

1. Where cable tray is to penetrate a fire rated wall or floor, the following installation method shall be used by this contractor:
2. Stop the tray at the penetration and fasten the tray end to the wall/floor.
3. For every 6" of tray width, furnish and install a 4" rigid galvanized nipple, threaded at both ends, through the penetration extending 4" beyond both sides and supported per section 26 05 29.
4. Provide a fiber or plastic bushing on one end and ground bushing on other.
5. Bond each grounding bushing to the equipment grounding conductor (or cable tray, if it is U.L. classified as an equipment grounding conductor) with a minimum #6 stranded copper wire using an U.L. listed connector.
6. Completely seal around the conduits with an U.L. listed fire rated assembly appropriate for penetration.
7. Completely seal the conduits that have conductors and cables passing through, with a U.L. approved fire rated sealant (putty or pillows).

8. Close off the unused conduits with a 14 Ga. steel plug held in place by the above required bushings.

L. Warning Signs

1. Provide warning signs at 15-foot intervals along cable tray. Adjust labeling interval to ensure that signs are visible.

M. Field Fabricated Corners, Offsets, or Reducers

1. Where Wire Basket Tray corners, offsets, or reducers are field fabricated, cut wires:
- a. According to manufacturer's instructions.
 - b. Using side action bolt cutters to ensure integrity of galvanic protective layer.
 - c. With one clean cut to eliminate grinding and/or touch-up.
 - d. Ensure that no sharp edges remain after field fabrication

END OF SECTION 26 05 36

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes the products and execution requirements relating to labeling of power, control, and signal wiring. Further, this section includes the installation of labels, nameplates, and directories for electrical junction boxes, wiring devices, and electrical equipment. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

1. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
2. Section 26 05 23 – Control-Voltage Electrical Power Cables

1.03 SUBMITTALS

A. Include schedule for nameplates.

B. Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8 1/2" x 11" sheets annotated, explaining their purposed use.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED.

B. All wiring labels shall be white/transparent vinyl or vinyl-cloth, self-laminating, wraparound type. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

C. Tape (wiring phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.

D. Nameplates: Engraved three-layer laminated plastic. Normal system shall use nameplates with black letters on white background, emergency system (NEC 700) shall use white letters on red background, legally required standby system (NEC 701) shall use white letters on blue background, and optional standby system (NEC 702) shall use white letters on yellow background.

E. Adhesive type labels not permitted except for identification of wires, wiring devices (device plates), 8” square and smaller junction boxes, and control devices.

F. See Junction and Pullbox Identification and Wiring Device Identification sections for allowed usage of permanent marker.

PART 3 - EXECUTION

3.01 GENERAL

A. All branch circuit and power panels shall be identified with the same symbol used in circuit directory in main distribution center.

B. Clean all surfaces before attaching labels with the label manufacturer’s recommended cleaning agent. Install all labels firmly as recommended by the label manufacturer. Labels shall be installed plumb and neatly on all equipment.

C. Install nameplates parallel to equipment lines.

D. Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.

E. Embossed tape will not be permitted for any application.

F. Provide a sign at the service-entrance equipment indicating type and location of on-site emergency power sources and on-site legally required standby power sources, per NEC 700.8 and NEC 701.9.

G. Provide a sign at each service disconnect indicating “Service Disconnect”, and locate above the main switch or circuit breaker, per NEC 230.70(B).

3.02 JUNCTION AND PULLBOX IDENTIFICATION

A. The following junction and pullboxes shall be identified utilizing spray painted covers:

<u>System</u>	<u>Color(s)</u>
Secondary Power – 480Y/277V	Brown
Secondary Power – 208Y/120V, 240/120V	White
Emergency System – Life Safety Branch (NEC 700) – 480Y/277V	Brown/Red
Emergency System – Life Safety Branch (NEC 700) – 208Y/120V	White/Red
Legally Required Standby System (NEC 701) – 480Y/277V	Brown/Blue
Legally Required Standby System (NEC 701) – 208Y/120V	White/Blue
Optional Standby System (NEC 702) – 480Y/277V	Brown/Yellow
Optional Standby System (NEC 702) – 208Y/120V	White/Yellow

<u>System</u>	<u>Color(s)</u>
Fire Alarm	Red
Temperature Control	Green
Door Control and Door Monitoring System	Orange
Sound and Intercom Systems	Gray
Video Surveillance System/MATV	Yellow
Data	Blue

B. Additional required junction and pullbox identification shall include:

1. Provide circuit numbers and source panel designations for power wiring junction boxes. Other system junction boxes shall be identified as shown on details or approved shop drawings. Temperature control boxes shall identify the source.
2. Where exposed, junction boxes larger than 8" square shall utilize engraved nameplates with ½" minimum letter height. Identify system source(s) and load(s) served.
3. Where exposed, 8" square and smaller junction boxes shall utilize machine generated, adhesive labels.
4. Where located above an accessible ceiling, junction boxes may be neatly identified using a permanent marker.

3.03 COMMUNICATION CONDUIT LABELING

- A. All conduits installed between Telecommunication Equipment Rooms shall be clearly labeled according to ANSI/TIA/EIA-606. Both ends of the conduits shall be labeled.
- B. All labels shall be mechanical, no hand written labels.
- C. The label shall indicate the location of the far end of the conduit run and a unique conduit number. (i.e. TR-1A-01 or Room #216 – 01).

3.04 POWER, CONTROL AND SIGNAL WIRE IDENTIFICATION

- A. Provide wire labels on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control and signal wiring.
- B. All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled as soon as it is terminated including wiring used for temporary purposes.

3.05 WIRING DEVICE IDENTIFICATION

A. Wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, photocells, and time clocks shall be identified with circuit numbers and source (ex. Panel ABC-3). In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated adhesive labels, or neatly hand-written permanent marker.

3.06 NAMEPLATE ENGRAVING FOR ELECTRICAL EQUIPMENT

A. Provide nameplates of minimum letter height as scheduled below.

B. Distribution Panelboards, Branch Panelboards,: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source. Panelboards serving NEC 700, 701 or 702 loads shall identify which branch they serve.

C. Circuit Breakers, Switches, 1/2 inch (13 mm); identify circuit and load served, including location.

D. Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, and Motor Starters: 1/2 inch (13 mm); identify source and load served.

3.07 PANELBOARD DIRECTORIES

A. Typed directories for panels must be covered with clear plastic, and have a metal frame. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

END OF SECTION 26 05 53

SECTION 26 09 23 – LIGHTING CONTROLS DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide and install all automatic lighting controls as shown on the Drawings and as specified within.
- B. Model numbers on the Drawings take precedence over model numbers listed in this specification.

1.02 SHOP DRAWINGS

- A. Required.
- B. Provide manufacturer's standard literature for each project proposed for the project.

1.03 SPECIAL PROJECT CONDITIONS

- A. All wall-mounted occupancy sensors for this project shall match color of electrical devices.

PART 2 - PRODUCTS

2.01 WALL-MOUNTED OCCUPANCY SENSORS – SINGLE RELAY

- A. Wattstopper Model PW-100.
 - 1. Equal products by Mytech, Novitas, Leviton or Uenco are acceptable.
- B. Switch mounts in standard single gang electrical box, or may be gang-mounted with additional decorator-type electrical devices.
- C. Switch works on infrared sensing only.
- D. 800 watts load rating with incandescent or fluorescent loads (using magnetic or electronic ballasts).
- E. Adjustable time delay from 15 sec. up to 30 minutes.
- F. Field-adjustable sensitivity and light level.
- G. 180 degree coverage up to 10 feet in radius.

2.02 WALL-MOUNTED OCCUPANCY SENSORS – DUAL RELAY

- A. Wattstopper model PW-200
 - 1. Equal products by Mytech, Leviton, Novitas or Uneco are acceptable.
- B. Switch mounts in a standard single-gang electrical box, or may be gang-mounted with additional decorator-type electrical devices.
- C. Passive infrared dual relay (Dual-switching) wall switch
- D. 120/277 VAC, 800 watts load rating
- E. Time delays: Fixed (5, 10, 15, 20, 25, or 30) walk-thru test mode.

2.03 CEILING-MOUNTED ULTRASONIC OCCUPANCY SENSORS

- A. Based on products by Wattstopper.
 - 1. Equal products by Mytech or Novitas are acceptable.
- B. Sensor shall be Wattstopper Model WT-605.
- C. Power pack shall be Wattstopper Model BZ-100.
- D. Sensor mounts over a standard octagon box, or may be supported independently on a suspended ceiling system.
- E. Power pack mounts to a standard electrical box using knockout to separate low voltage from high voltage.
- F. Include low voltage sensor wiring. 3-conductor, #18 AWG minimum, with overall non-shielded jacket, plenum-rated where located in air-return plenums.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Mount automatic controls where shown on the Drawings. Ceiling-mounted sensors shall be coordinated with lighting, HVAC diffusers/grilles, etc.
- B. Make all wiring connections per manufacturer direction.
- C. At completion of installation, adjust light level and sensitivity as needed for proper operation.

3.02 90 DAY RE-ADJUSTMENT

A. After 90 days of “normal” use by the Owner, this contractor shall re-adjust the sensitivity, lighting levels and devices locations as necessary for proper and acceptable operation.

END SECTION 26 09 23

SECTION 26 09 43 – NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.01 SCOPE

- A. Provide materials, labor and incidentals necessary for the completion of this Section of the Work.
- B. Provide, install, test, adjust and place into service, low voltage lighting control systems as shown or indicated in the Drawings, with all accessories, control inputs, switched outputs, and programming controls as required for a complete operational system.

1.02 SUBMITTALS

- A. Required.
- B. Submit manufacturer's data sheets on all components proposed for this installation.
- C. Submit a wiring diagram specific to this installation, clearly showing all components, all wiring and cable types and connections, and all operating settings.

1.03 QUALITY CONTROL

- A. Manufacturer of "system" shall have been in this specific business for minimum of 10 years.
- B. Products proposed for this installation shall have been manufactured for a minimum of 5 years with minimal revisions.

PART 2 - PRODUCTS

2.01 LOW VOLTAGE LIGHTING CONTROL – SWITCHING DUTY ONLY (LCP-1)

- A. Based on products by Hubbell, Commercial 'CX'.
 - 1. Equal products by Douglas, LC&D, Nex-Lite, Leviton or Wattstopper will be acceptable.

- B. Provide a Low Voltage Lighting Control System to control devices or equipment, as shown on the drawings, diagrams and schedules, complete with all devices including relays, switches, transformers, switch plates, pilot lights, relay panels, photo-cell, etc., required to make a complete, functioning system.
- C. Install all relays and associated hardware and equipment in relay panel.
- D. Relay panels shall be surface-mounted and UL listed.
- E. Relays shall provide manual override capability and visual load status.
- F. Manual switches shall be capable of containing up to eight (8) switches per gang and each switch shall include LEDs for both "ON and "OFF" load status. Wall plates shall be thermoplastic.
- G. Provide photocell, and control for relays as noted on the drawings.
- H. Refer to Details on the Drawings for specific requirements.
- I. LCP-1:
 - 1. Provide (8) 20 amp, 120/277 VAC single pole relays.
 - 2. Provide integral timeclock with a minimum of (8) output channels.
 - 3. Provide an exterior photocell with variable light sensing and required photocell controller.
 - 4. Provide manual lighting control stations as indicated on the drawings.

PART 3 - EXECUTION

3.01 LOW VOLTAGE LIGHTING CONTROLS

- A. Install panels and/or controllers where shown on Drawings.
- B. Make all wiring connections per manufacturer's project-specific wiring diagram.
- C. Low voltage conductors to remote switches shall be run in raceway per Specification 26 05 33.

3.02 TESTING AND INSTRUCTIONS

- A. At completion of the installation, test each switch, each relay, and each auxiliary input device for proper operation.
- B. Lighting controlled by photocell shall be tested at night under actual low ambient lighting levels.

C. Instruct Owner on proper operation and maintenance of total system, including programming changes.

D. Provide four hours on site training to demonstrate the controls to up to 2 different staff members of this facility.

END SECTION 26-09-43

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes main, distribution and branch circuit panelboards. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1. Section 26 43 13 - Surge Protective Devices for Low Voltage Electrical Power Circuits

1.03 SUBMITTALS

A. Include outline and support point dimensions, voltage, main bus ampacity, circuit breaker arrangement and sizes, and interrupting ratings confirming a fully-rated system for all equipment and components.

1.04 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.05 SPARE PARTS

A. Keys: Furnish 2 keys for each panelboard to Owner.

B. One set of three spare fuses of each size and type utilized

PART 2 - PRODUCTS

2.01 POWER DISTRIBUTION PANELBOARDS

A. Panelboards: Circuit breaker type.

B. The panelboard and overcurrent devices contained within shall be fully-rated.

C. Enclosure: NEMA Type 1 or as scheduled. Minimum cabinet size: 6.5 inches (165 mm) deep; 26 inches (660 mm) wide. Constructed of galvanized code gauge steel.

- D. Power distribution panelboards installed in electrical rooms and mechanical rooms shall utilize a standard dead front cover. In all other areas provide cabinet front with hinged door, flush lock and hinged trim (door-in-door) to allow access to wiring gutters without removal of panel front. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.
- E. Provide metal directory holders with clear plastic covers.
- F. Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.
- G. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings and as required by Local Utility Company.
- H. The circuit breakers are to be totally front accessible and mounted in the panelboard to permit installation, maintenance and testing without reaching over line side bussing. The circuit breakers are to be removable by the disconnection of only the load side terminations and line and load side connections are to be individual to each circuit breaker. Common mounting brackets or electrical bus connectors are not acceptable.
- I. Circuit breakers shall be provided with provisions for mounting handle padlock attachments.
- J. Breaker feeder lugs shall be dual rated for use with either aluminum or copper conductors.
- K. Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate, as well as exercise the circuit breaker operating mechanisms.
- L. A minimum of 25% future circuit breaker spaces shall be included. Spaces for future circuit breakers shall be "prepared" spaces. These spaces shall be provided with the necessary mounting hardware and bus extensions so that when future breakers are added, only the breaker itself needs to be purchased by the installer.
- M. Circuit breakers serving single motor loads shall be magnetic only, instantaneous trip. Overload protection shall be part of the motor combination controller.

N. Circuit Breakers:

1. Electronic Trip Circuit Breakers: As scheduled on the drawings, electronic circuit breakers shall have, at a minimum, adjustments for long time, short time and instantaneous trip. Provide integral ground fault sensing with adjustable ground fault trip where indicated on the drawings.
2. Molded Case Circuit Breakers: As scheduled on the drawings, integral thermal and instantaneous magnetic trip elements in each pole.

2.02 BRANCH CIRCUIT PANELBOARDS

- A. Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.
- B. The panelboard and overcurrent devices contained within shall be fully-rated.
- C. Enclosure: NEMA Type 1 or as scheduled. Minimum cabinet size: 5-3/4 inches (144 mm) deep; 20 inches (508 mm) wide with 5" minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.
- D. Provide cabinet front (flush or surface per plans) with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.
- E. Provide metal directory holders with clear plastic covers.
- F. Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings.
- G. Provide ground bars in all panelboards. Phase, neutral and ground bar terminations can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.
- H. Incoming conductors shall terminate at lug landing pads rated for the panelboard.
- I. Provide compression type lugs to accommodate the conductor shown on drawings.
- J. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.
- K. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers. Provide UL Class A ground fault interrupter circuit breakers where shown on Drawings. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

- L. Do not use tandem circuit breakers.
- M. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.
- N. All of the panelboards provided under this section shall be by the same manufacturer.
- O. All sub-feed panelboards installed side by side shall utilize same enclosure height.

2.03 SURGE PROTECTIVE DEVICE

- A. In Power Distribution Panelboards used as service entrance equipment, provide a surge protective device meeting the requirements of specification section 26 43 13. Surge protective devices shall be served from an overcurrent protective device within the power distribution panelboard.
- B. Surge protective device shall be installed external to the power distribution panelboard.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. See section 26 05 29 for support requirements.
- B. Install panelboards plumb with wall finishes.
- C. Height: 6 feet (2 m) to top.
- D. Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.
- E. Provide filler plates for unused spaces in panelboards.
- F. See section 26 05 53 for identification requirements. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- G. Stub three (3) empty 3/4" conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

END OF SECTION 26 24 16

SECTION 26 27 02 – EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes electrical connections to equipment specified under other Divisions and/or Sections, or furnished by Owner, including, but not limited to:

1. HVAC motors, VFDs, and panels
2. Plumbing motors, VFDs, and panels
3. Misc. Equipment

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
2. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.03 SUBMITTALS

A. Product Data: Provide data for cord and wiring devices.

1.04 COORDINATION

A. Coordinate all equipment requirements with the various contractors and the Owner. Review the complete set of drawings and specifications to determine the extent of wiring, starters, devices, etc., required.

PART 2 - PRODUCTS

2.01 CORDS AND CAPS

A. Straight-blade Attachment Plug: NEMA WD 1.

B. Locking-blade Attachment Plug: NEMA WD 5.

C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

D. Cord Construction: Oil-resistant thermoset insulated multiconductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

- E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

2.02 OTHER PRODUCTS

- A. Refer to related sections for other product requirements.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 PREPARATION

- A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.03 INSTALLATION

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
- B. Provide a green equipment ground conductor for all installed equipment wiring.
- C. Make conduit connections to equipment using flexible PVC-coated metal conduit.
- D. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- E. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- F. Make wiring connections in control panel or in wiring compartment of pre-wired equipment according to manufacturer's instructions. Provide interconnecting wiring where indicated.
- G. Install, disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.

3.04 HVAC AND PLUMBING CONNECTIONS

- A. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, variable frequency drives (VFDs), and

disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.

B. Contractor shall verify with mechanical contractor the electrical requirements including voltages, horsepower, disconnecting means, starters and variable frequency drives for motors and equipment prior to ordering circuit breakers, disconnects and starters.

C. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.

D. Provide 120 volts to each temperature control panel. Coordinate quantity and exact locations with HVAC/DDC contractors.

E. Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure switches, fan powered VAV boxes, switches, electro-pneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired by the Contractor supplying the devices.

F. Each motor terminal box shall be connected with a minimum 12", maximum 36" piece of flexible PVC-coated metal conduit to a fixed junction box. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

G. Check for proper rotation of each motor.

H. All heating, air conditioning and refrigeration equipment installed on the exterior of the building or rooftop shall have a 120V, single phase 20 ampere rated outlet at an accessible location within 25 feet of the equipment.

END OF SECTION 26 27 02

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, and photo cells. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITTALS

A. Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

B. For occupancy sensor shop drawings, the manufacturer's actual layout of occupancy sensors and the wiring diagrams shall be provided.

1.04 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 WALL SWITCHES

A. General: Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade.

B. Handle: Ivory made of nylon or high impact resistant material.

C. All switches on emergency circuits shall have a red handle with matching red cover plate.

D. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with separate green ground screw. Switches shall be Cooper Arrow-Hart 1221*, Hubbell 1221*, Leviton 1221-S*, Pass & Seymour CS20AC1-*, or approved equal. (* indicates color selection).

2.02 RECEPTACLES

- A. General Requirements: NEMA Type 5-20R, Ivory nylon or high impact resistant face. Receptacles shall be UL498 Listed and meet Federal Specification WC-596. All duplex receptacles shall be heavy duty Specification Grade, 20 amp rated.
- B. Generally, all receptacles shall be duplex convenience type unless otherwise noted.
- C. All receptacles on emergency circuits shall have a red face with matching red cover plate.
- D. All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of the receptacle.
- E. All receptacles installed in bathrooms, kitchens, and within 6 feet of the outside edge of sinks shall be GFCI type.
- F. All receptacles installed in outdoor locations, garages, rooftops, and in other damp or wet locations shall be GFCI type with a weather-resistant (WR) rating.
- G. Convenience and Straight-blade Receptacles: All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles shall be Cooper Arrow-Hart 5362*, Hubbell 5362*, Leviton 5362-S*, Pass & Seymour PS5362-*, or approved equal. (* indicates color selection).
- H. GFCI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A. GFCI receptacles shall be Cooper Arrow-Hart VGF20*, Hubbell GF20*L, Leviton N7899-*, Pass & Seymour 2095*, or approved equal.
- I. GFCI Receptacles with a weather-resistant (WR) rating: Weather-Resistant duplex convenience receptacle with integral ground fault current interrupter meeting the requirements of UL standard 943 Class-A. WR GFCI receptacles shall be Cooper Arrow-Hart WRVGF20*, Hubbell GFR5362*TR, Leviton WR899-*, Pass & Seymour 2095TRWR*, or approved equal.
- J. Locking-Blade Receptacles: As indicated on drawings.
- K. Specific-use Receptacle Configuration: As indicated on drawings.

2.03 OCCUPANCY SENSORS

- A. All occupancy sensors shall be hardwired type; battery type shall not be permitted.
- B. Wall Mounted (Wall Switch Type)

1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard single gang switch box.
2. Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz
3. Sensitivity shall be user adjustable or self-adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
5. The sensor shall have two switches where dual-level lighting is required. The off switch shall have manual override for positive off and automatic on.
6. The test LED shall indicate motion.
7. The area of coverage shall be approximately 180 degrees by 35-40 feet.
8. The unit shall have a five year warranty.

C. Ceiling Mounted

1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.
2. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Line voltage sensors are acceptable, especially in exposed ceiling areas where all wiring shall be installed in conduit, including low voltage cabling if power packs are used. Provide power pack as required for low voltage sensors.
3. Sensitivity shall be user adjustable or self-adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
5. The coverage area shall be 360 degrees by approximately 15 feet radius when mounted at 9 foot height. The sensor shall have provisions, such as masking, to block out problem areas.
6. Test LED to indicate motion.

7. The unit shall have a five year warranty.
8. See drawings for actual type of sensor.

2.04 WALL DIMMERS

- A. Wall Dimmers: linear slide semiconductor type.
- B. Rating: 600 Watts minimum, larger size to accommodate load shown on Contract Drawings.
- C. Dimmer must be compatible with LED lighting fixtures.
- D. Provide 0-10V control wiring where required.

2.05 DEVICE PLATES AND BOX COVERS

- A. Standard Cover Plate: Ivory smooth thermoplastic nylon. Note requirement for red plates on emergency outlets and switches.
- B. Weatherproof Cover Plate: Gasketed metal with hinged "in-use" device covers, powder coat painted. Non-metallic covers are not allowed. All receptacles installed in wet locations shall have an enclosure that is weatherproof whether or not the attachment plug is inserted.
- C. Damp Location Cover Plate: Gasketed metal with hinged device covers, powder coat painted. Non-metallic covers are not allowed. All receptacles installed outdoors in a location protected from the weather or in other damp locations shall have an enclosure that is weatherproof when the receptacle is covered (attachment plug not inserted and receptacle covers closed).
- D. Surface Cover Plate: Raised galvanized steel.

2.06 PHOTO CELLS

- A. The controller shall be rated 2000 watts tungsten at 120, 240 or 277 volts. The cell shall be cadmium sulfide, 1" diameter.
- B. The enclosure shall be die cast zinc, gasketed for maximum weather proofing.
- C. The enclosure shall include the positioning lug on the top of the enclosure.
- D. The unit shall have a delay of up to two minutes to prevent false switching. ON/Off adjustment shall be done by moving a light selector with a range from 2 to 50 foot-candles.
- E. Mounting shall be for a 1/2" conduit nipple.

- F. The unit shall have a 5 year warranty.
- G. The contacts shall be SPST normally closed.
- H. The operational temperature range shall be -40 to 140 degrees F (-40 to +60 degrees C).
- I. Photocell must be compatible with Lighting Control Panel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. See plans for device mounting heights.
- B. Install wall switches with OFF position down.
- C. Wall dimmers: de-rate ganged dimmers as instructed by manufacturer; do not use common neutral.
- D. Install convenience receptacles with grounding pole on bottom.
- E. Install box for information outlet at the same height as adjacent convenience receptacles. Locate boxes for information outlet as close as practical to duplex power outlet, approximately 2-inches apart.
- F. Install box for telephone jack for wall telephone at 46-inches to center above finished floor.
- G. Install specific-use receptacles at heights shown on Contract Drawings.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- J. Install devices and wall plates flush and level.
- K. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.
- L. Drill opening for poke-through fitting installation according to manufacturer's instructions.

3.02 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch and sensor with circuit energized, and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.03 OCCUPANCY SENSORS

- A. Power packs used in return air plenum ceiling areas shall be installed in an approved enclosure or UL listed for return air plenum.
- B. Provide a minimum of 4' of coiled cable for ceiling-mounted sensors.
- C. Occupancy sensors shall be installed at locations indicated on the manufacturer's submittal layout drawings. Sensors shall be located to prevent false "ON" tripping of the lights.
- D. Sensitivity Test: After the sensor has been energized for at least 15 minutes, walk to the middle of the room (if conference room) or sit at the normal desk position (if an office). Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink.
- E. Time Delay Test: Set the time delay for 10 minutes. Walk into the room to activate the sensor then leave room. Sensor must turn lights off at approximately 10 minutes. Walk into the room again to reactivate the lights. Lights should activate within 1 second.

3.04 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Mark all conductors with the panel and circuit number serving the device with a machine generated label, at the device, and on the back of the device cover.

END OF SECTION 26 27 26

SECTION 26 27 28 – DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes disconnect switches, fuses and enclosures. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1. Section 26 27 02- Equipment Wiring Systems
2. Section 26 29 00- Low voltage Controllers

1.03 SUBMITTALS

A. Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

1.04 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.05 GENERAL

A. Provide disconnect switches for loads required by code. Review HVAC and Plumbing specifications to determine what equipment is furnished with disconnect switches. Install disconnect switches whether furnished under this contract or not. It is the Electrical Contractors responsibility to determine the need for a disconnect switch for each load. The contractors shall include in their bid the code required disconnect switches whether indicated on the drawings or not.

PART 2 - PRODUCTS

2.01 DISCONNECT SWITCHES

A. Fusible Switch Assemblies (use only when overcurrent protection is required): NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: designed to accommodate Class R, Class J or Class CC (motors) cartridge type fuses.

B. Nonfusible Switch Assemblies: NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosure:

1. Indoor: NEMA 1 code gauge steel with rust inhibiting primer and baked enamel finish

2. Outdoors: NEMA 3R code gauge zinc coated steel with baked enamel finish or NEMA 4 when indicated on drawings.

D. Provide manufacturer's equipment ground kit in all disconnect switches.

E. In applications where the switch serves as the service entrance disconnect, provide service ground kit, label as service disconnect and provide UL listing for service disconnect.

2.02 FUSES

A. Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class RK 1, LPJ Interrupting Rating: 200,000 rms amperes.

B. Fuses 601 Amperes and Larger: Low Peak, time delay, 600 volt, UL Class L. Interrupting Rating: 200,000 rms amperes.

C. Fuses 30 Amperes and less: Time-Delay, 600 volt, UL Class CC. Interrupting rating: 200,000 rms amperes.

D. Provide three (3) spares of each size and type fuse. Provide cabinet/enclosure for spare fuses sized to accommodate all required spare fuses for entire facility. Locate cabinet in main electrical room.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install disconnect switches where indicated on Drawings or required by NEC.

B. Provide identification as specified in Section 26 05 53.

C. Provide label on inside of disconnect cover identifying the type and size of fuse to be utilized.

END OF SECTION 26 27 28

SECTION 26 28 13 – FUSES

PART 1 - GENERAL

1.01 SCOPE

- A. The work under this section includes 250 and 600 volt fuses.

1.02 RELATED WORK

- A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITTALS

- A. Provide device dimensions, nameplate nomenclature, and electrical ratings.
- B. Submit manufacturer's product data sheets with installation instructions.

1.04 REGULATORY REQUIREMENTS

- A. Listed by Underwriter's Laboratories, Inc., and suitable for specific application.

1.05 EXTRA MATERIALS

- A. Provide three (3) spares of each size and type fuse.

PART 2 - PRODUCTS

- A. Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class RK 1, LPJ Interrupting Rating: 200,000 rms amperes.
- B. Fuses 601 Amperes and Larger: Low Peak, time delay, 600 volt, UL Class L. Interrupting Rating: 200,000 rms amperes.
- C. Fuses 30 Amperes and less: Time-Delay, 600 volt, UL Class CC. Interrupting rating: 200,000 rms amperes.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fuses shall not be installed until equipment is ready to be energized.

END OF SECTION 26 28 13

SECTION 26 29 00 – LOW-VOLTAGE CONTROLLERS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes manual motor starters, magnetic motor starters, combination magnetic motor starters.

1.02 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this Section.

1. Section 26 05 29 - Hangers and Supports for Electrical Systems

1.03 COORDINATION WITH OTHER TRADES

A. Motors: In general, all electric motors required for this installation will be supplied with equipment, apparatus and/or appliances covered under other sections of the specifications.

B. For the sake of consistency and conformity of manufacturer, design and construction, all motors shall conform to the following description unless otherwise noted or required.

C. Motors 1/3 HP and smaller shall be wound for operation on single phase, 60 Hz. service unless otherwise noted.

D. Refer to drawings in each case in order to verify voltage characteristics required.

E. Equipment:

1. All building utility motors such as fans, pumps, overhead doors, etc., together with certain "controlling equipment" for same, except motor starters and related apparatus, will be furnished under other sections of the specifications and delivered to the building site unless specifically noted otherwise. The above mentioned "controlling equipment" pertains to electrical thermostats, electro-pneumatic and pneumatic-electric and detection devices, or any other device not purely electrically operating in nature.

2. The starters for these motors shall be furnished and installed by the Electrical Trade unless noted otherwise (See Motor Schedule on Drawings).

F. The Electrical Trade shall set and connect all specified starting equipment, install all power conduits and wiring and shall furnish and make all connections from starting equipment to motors as required to leave the apparatus in running condition.

G. Wiring Connections:

1. Furnish branch circuits for all motors to the starting equipment and then to the motors, complete with all control wiring for automatic and remote control where required or noted. Conduits to motors shall terminate in the conduit fittings on the motors, the final connection being made with flexible, PVC-coated metal conduit.

H. Provide all necessary labor and material to completely connect all electrical motors and controls (where required) in connection with the building utility equipment, including fans, pumps, overhead door operators, etc.

I. All conduits and wiring required for control work from the holding coil circuit of the starter, including the furnishing and installation of control devices such as auxiliary contacts, control relays, time delay relays, pilot lights, selector switches, alternators, etc., shall be provided and installed by other trades unless otherwise indicated.

J. Power Branch Circuits:

1. Wire sizes for branch circuits not specifically called for on drawings or in specifications shall be based on 125 percent of the full load current of the motor unless the voltage drop of motor branch circuits exceeds 1-1/2 percent from the distribution panel to the motor; in which case, voltage drop shall govern wire sizes. A power factor of 80 percent shall be used for motors in such calculations.

1.04 REFERENCES

ANSI/NEMA ICS 6 - Industrial Control and Systems: Enclosures.

ANSI/UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses.

NEMA AB 1 - Molded-case Circuit Breakers, Molded Case Switches, and Circuit-breaker Enclosures.

NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts.

NEMA ICS 18 - Motor Control Centers.

NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches.

NEMA PB 1 - Panelboards.

NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

1.05 SUBMITTALS

A. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle according to manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.08 SPARE PARTS

A. Keys: Furnish two (2) each to Owner.

B. Provide three (3) spares of each size and type fuse used. Provide enclosure for spare fuses.

C. Fuse Pullers: Furnish one fuse puller to Owner.

PART 2 - PRODUCTS

2.01 MANUAL MOTOR STARTERS

A. Single-phase Manual Motor Starter: Provide a motor-rated toggle switch.

B. Manual Motor Starter: NEMA ICS 2; size as shown on Drawings. AC general-purpose Class A manually operated full-voltage controller for induction motors rated in horsepower, with overload protection, red pilot light and toggle operator.

C. Enclosure: NEMA Type 1, or as indicated on the drawings.

D. Provide manufacturer's equipment grounding kit in all starter enclosures.

2.02 MAGNETIC MOTOR STARTERS

A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower; size 0 minimum.

- B. Full Voltage Starting: Non-reversing type.
- C. Size: NEMA ICS 2; size as shown on Drawings, size 0 minimum.
- D. Coil Operating Voltage: 120 volts, 60 Hz.
- E. Overload Protection: The overload shall be solid-state, self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard, and be ambient insensitive. The overload shall have a mechanical test function.
- F. Enclosure: NEMA Type 1, or as indicated on the drawings.
- G. Provide manufacturer's equipment ground kit in all starter enclosures.
- H. Auxiliary Contacts: NEMA ICS 2, two (2) field convertible contacts in addition to seal-in contact.
- I. Selector Switches: NEMA ICS 2, HAND-OFF-AUTO in front cover.
- J. Indicating Lights: NEMA ICS 2; red "RUN" LED Push-to-test type in front cover.
- K. Control Power Transformers: Each magnetic starter shall have a fused primary and a fused 120Vsecondary control transformer, sized for the load, 50 VA minimum. Additionally, the X2 terminal of the control transformer shall be grounded.
- L. Combination Motor Starters: Combine motor starters with motor circuit protector disconnect in common enclosure.

2.03 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

- A. Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.

2.04 FUSES

- A. Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class J. Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install motor control equipment according to manufacturer's instructions.

- B. Set overload protection in motor starters to match installed motor characteristics.
- C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION 26 29 00

SECTION 26 32 00 – PACKAGED GENERATOR ASSEMBLIES

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes providing a complete factory assembled packaged engine generator system with controls and startup testing. PLEASE NOTE: THIS GENERATOR SHALL INCLUDE A DUAL FUEL SOURCE – NATURAL GAS AND LP. INCLUDE ALL ACCESSORIES REQUIRED FOR A COMPLETE OPERATING SYSTEM UTILIZING DUAL FUEL. TESTING SHALL INCLUDE BOTH FUEL SOURCES.

1.02 RELATED WORK

- A. Applicable provisions of Division 01 govern work under this section.
- B. Section 26 36 23- Transfer Switches.

1.03 REFERENCES

- A. NFPA110 – Emergency and Standby Power Systems.
- B. ANSI/NEMA MG 1 - Motors and Generators.

1.04 PERMITS

A. The Contractor shall be responsible for obtaining all necessary permits for the complete installation of the generator fuel system and related equipment.

1.05 SUBMITTALS

- A. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical ratings and diagrams including schematic and interconnection diagrams.
- B. Submit manufacturer's installation instructions.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.07 QUALITY ASSURANCE

A. Manufacturer: Kohler

B. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 200 miles of project site.

1.08 EXTRA MATERIAL

A. Provide two additional sets of each fuel, oil, and air filter elements required for the engine generator system and one additional set of all required belts.

PART 2 - PRODUCTS

2.01 SYSTEM RATINGS

A. Generator Set Rating: 100 KW/KVA, .8pf, 120/240 VAC, Single phase, 3 wire, 12 wire re-connectable, 60 Hz at 1,800 rpm. Standby power rated.

B. Motor starting KVA shall be KVA based on a sustained RMS voltage drop of no more than 10% of no load voltage with the specified KVA load at near zero power factor applied to the engine-generator set.

C. The generator set manufacturer shall verify the engine as capable of driving the generator with all accessories in place and operating at the nameplate rating after de-rating for the range of temperature expected in service and the altitude of the installation.

D. The engine-generator set shall be capable of picking up 100% of nameplate kW, less applicable derating factors, in one step with the engine-generator set at operating temperature.

E. Voltage regulation shall be $\pm 1.0\%$ of rated voltage for any constant load between no load and rated load. Random voltage variation with any steady state load from no load to full load shall not exceed $\pm 1.0\%$ of rated voltage.

F. Frequency regulation shall be $\pm 0.5\%$ from steady state no load to steady state rated load.

G. Harmonic distortion shall not exceed 5% total harmonic distortion at full linear load and no single harmonic shall exceed 3% of rated voltage.

2.02 ENGINE AND ENGINE EQUIPMENT

A. Engine Type: Water-cooled, turbo-charged, four cycle, internal combustion engine.

B. Fuel Type: Natural gas and LP. Please coordinate thoroughly with Generator manufacturer to include all accessories to accommodate DUAL-FUEL source.

C. Engine Speed: 1,800 rpm.

D. Governor: Isochronous electronic type to maintain engine speed within 0.5 percent, steady state, and 1 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes.

E. Safety Devices: Engine shutdown on high water temperature, low oil pressure, over speed, and engine overcrank. Limits as selected by manufacturer.

F. Include remote starting control circuit, with RUN-OFF-AUTO selector switch on engine generator control panel.

G. Engine Accessories: Include intake air filter, fuel filter, fuel priming pump, automatic electric fuel shutoff, fuel/water separator, gear-driven water pump, positive displacement mechanical full pressure lubrication oil pump, full flow lubrication oil filters with replaceable elements, dipstick oil level indicator, and oil drain valve with hose extension. Include engine mounted battery charging alternator with solid state voltage regulator. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.

H. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C). Heater voltage shall be 120 VAC.

I. Mounting: Provide unit with suitable spring-type vibration isolators and mount on concrete base. Consult manufacturer for recommended mounting.

J. Cooling System: Unit mounted radiator using glycol coolant, with blower type fan, coolant pump and thermostat temperature control sized to maintain safe engine temperature in ambient temperature of 110 degrees F. The equipment supplier shall provide 50% ethylene glycol antifreeze solution to fill engine cooling system.

K. Exhaust System:

1. Provide critical grade silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized according to engine manufacturer's instructions. Contractor shall mount muffler so its weight is not supported by the engine.

2. Flexible exhaust connections shall be provided as required for connection between engine exhaust manifold and exhaust line, in compliance with applicable codes and regulations.

3. Provide an exhaust condensation trap with manual drain valve to trap and drain off exhaust condensation and to prevent condensation from entering the engine. Provide drain line to drip pan.
4. Provide a suitable rain cap at the stack outlet. Provide all necessary flanges and special fittings for proper installation.
5. Contractor shall mount and install all exhaust components as required to comply with applicable codes and regulations. All components shall be properly sized to assure proper operation without excessive back pressure when installed as shown on the drawings. Make provisions as required for pipe expansion and contraction.

L. Fuel System:

1. The generator shall be capable of accepting natural gas fuel. Natural gas fuel will be the primary source of fuel.
2. Provide flexible supply and return line fittings and all connections for connecting fuel system to the engine in compliance with applicable codes and regulations. All fuel piping shall be pressure tested for minimum 2 hours.

M. Batteries:

1. Heavy duty starting type, lead-acid storage batteries. Provide a DC volt system with number of batteries and battery capacity as sized by the manufacturer adequate for (4) 30 second cranking periods (total of 2 minutes) along with all additional loads being run on the DC system.

2.03 GENERATOR

A. Insulation: ANSI/NEMA MG 1, Class H.

B. The generator shall be single bearing, self-aligning 4-pole, brushless, synchronous type, revolving field with amortisseur windings, and with direct driven centrifugal blower for proper cooling and minimum noise. No brushes will be allowed. Generator shall be directly connected to engine fly wheel housing and driven through a flexible coupling to ensure permanent alignment. Generator design shall prevent potentially damaging shaft currents.

C. The generator shall be 3-phase, broad-range, re-connectable and shall have 12 leads brought out to allow connection by user to obtain any of the available voltages for the unit.

D. The regulator design shall include torque-matching characteristics to allow the engine to use its fullest power producing capacity (without exceeding it or over compensating) at speeds lower than rated, to optimize motor starting capability and provide the fastest possible recovery from transient speed dips. Regulators which use a fixed volts per hertz characteristic are not acceptable.

E. Provide an exciter field automatic circuit breaker, mounted on the control panel, of the manual reset only type (cannot be used as a manual disconnect) for protection of exciter field and regulator.

F. The generator, exciter, and voltage regulator shall be designed and manufactured by the engine generator set manufacturer. The exciter shall be 3-phase, full wave, rectified with heavy duty silicone diodes mounted on the common rotor shaft and sized for maximum motor starting loads. Systems utilizing 3-wire, solid state control elements rotating in the rotor, will not be acceptable. The generator design shall be of the self-protecting type as demonstrated by the prototype short circuit test.

G. Provide a mainline molded case circuit breaker as recommended by manufacturer, on generator output with integral thermal and instantaneous magnetic trip in each pole; number and rating as indicated. Include battery-voltage operated shunt trip, connection to open circuit breaker on engine failure. Mount unit in enclosure to meet ANSI/NEMA 250, Type 1 requirements.

2.04 ACCESSORIES

A. Provide the following accessories with the engine generator set.

B. Enclosure: Standard Weather protective housing with the following features:

1. Galvanized steel body
2. Lifting points on base frame
3. Stainless steel flush fitting latches and hinges
4. Zinc plated or stainless steel fasteners
5. Sheet steel components pre-treated with zinc phosphate prior to polyester powder coating
6. Lockable wide door on each side installed to allow 180 degree opening rotation
7. Radiator fill access door with lockable cover
8. Lube oil and coolant drains piped to the exterior of the enclosure skid base

9. Lockable fuel fill cap
 10. Battery can only be reached through lockable doors
 11. UL listed base tank sized as indicated elsewhere in these specifications
- C. Battery Heater: Thermostatically controlled battery blanket heater, 120VAC.
- D. Battery Tray: Plastic coated metal tray treated for electrolyte resistance, constructed to contain spillage of electrolyte.
- E. Battery Charger: A 10-ampere voltage regulated battery charger shall be provided for the engine-generator set. Charger shall be equipped with float, taper and equalize charge settings. Charger shall include overload protection, voltage surge suppressor, DC voltmeter and fused AC input. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30 VDC for remote indication of:
1. Loss of AC power-red light (no relay contact).
 2. Low battery voltage-red light.
 3. High battery voltage-red light (no relay contact).
 4. Charger fail-red light.
- F. Engine-Generator Digital Control Panel: Top of control panel shall not be more than six (6) feet above finished floor. NFPA - 110 and NFPA - 99, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include the following features:
1. Power source with circuit protection: 12or 24 VDC.
 2. Operating temperature range: -40degree C to +70 degree C.
 3. Humidity range: 5% to 95% non-condensing.
 4. Alarm horn.
 5. Indicators: not on auto, program, systems, and warning.
 6. Alphanumeric digital display.
 7. Keypad with multi-function soft membrane environmentally sealed cover.
 8. Frequency Meter.

9. True RMS AC Voltage.
10. AC Output Amperage.
11. Front mounted output voltage adjustment, locking screw driver type, to adjust voltage $\pm 5\%$ from rated value.
12. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
13. Push-to-test indicator lamps, one each for high engine temperature and low engine oil pressure pre-alarm and one run light.
14. A flashing red light to indicate the generator set is not in automatic start mode.
15. Engine run/off/auto selector switch.
16. Emergency stop “mushroom” switch.
17. Engine running time meter.
18. Oil pressure gauge.
19. Water temperature gauge.
20. Battery voltmeter.
21. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
22. Remote Alarm Contacts: Pre-wire form C contacts to terminal strip for remote alarm functions required by ANSI/NFPA 110.
23. Indicator lamps to include: overcrank, low oil pressure, high engine temperature, overspeed, not-in-auto, system ready, low battery volts, battery charger fault, low fuel, pre-alarm high engine temp, pre-alarm low oil pressure, low water temp, auxiliary alarm, auxiliary pre-alarm.

G. The NEMA 3R enclosed control panel shall be mounted on the generator set with vibration isolators. The control shall include surge suppression for protection of solid state components. A front control panel illumination lamp with On/Off switch shall be provided. The engine-generator set starting batteries shall power the monitor.

- H. Remote annunciation control panel:
1. Audiovisual annunciation with NFPA 110 level 1 capability.
 2. Programmable microprocessor logic and digital display features.
 3. Alternator safeguard circuit protection.
 4. 12 or 24 volt engine electrical system capability.
 5. Remote start, remote annunciation and remote communication options.
 7. AC meters and engine gauge features.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that required utilities are available in proper location and ready for use.

3.02 INSTALLATION

- A. Install according to manufacturer's instructions.
- B. Generator set shall be anchored to the concrete pad.

3.03 FIELD QUALITY CONTROL

- A. Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption.
- B. After the generator has cooled down from the four hour test, shut it down and then simulate a power failure including operation of the transfer switch, automatic cycle, and automatic shutdown and return to normal.

3.04 AGENCY TRAINING

- A. Provide factory training to Department of Transportation (minimum of 2 hours).

END OF SECTION 26 32 00

SECTION 26 36 23 – AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes transfer switches (less than 600V) for standby generator systems.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 26 32 00- Packaged Generator Assemblies.

1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in automatic transfer equipment with five years documented experience.

1.04 SUBMITTALS

A. Submit product data showing overall dimensions, electrical connections, electrical ratings, all specified accessories, interlock methods, and environmental requirements.

B. Submit manufacturer's installation instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

B. In addition to the general content specified under GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 AUTOMATIC TRANSFER SWITCH

A. Description: NEMA ICS 2; automatic transfer switch. In applications where the switch serves as the service entrance disconnect, the switch shall be rated as suitable for use as a service disconnecting means.

B. Configuration: The transfer switch shall be electrically operated and mechanically held. The electrical operation shall be by a solenoid mechanism operating from the same source to which the load is being transferred.

C. The switch shall be rated for continuous duty and be mechanically interlocked to be in either the normal or the emergency position.

D. The switch shall be controlled by electronic solid state components with printed circuit control boards, and industrial grade plug in control relays.

E. The switch shall be designed and built so that it can be manually operated under no-load conditions from behind a barrier partition or with the door closed. The enclosure shall allow for inspection of the internal operation of the switch through a full sequence of the transfer cycle with the door open and the switch de-energized.

2.02 RATINGS

A. Provide one (1) 400 amp. 3-pole, 120/240 volts, Single-phase, 3-wire, NEMA type 1 automatic transfer switch for Emergency Loads in Panelboard 'EMA'.

2.03 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

B. Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.

C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

D. Time Delay Before Transfer to Alternate Power Source: 0 to 60 seconds, adjustable.

E. Initiate Re-transfer Load to Normal Source: Upon permission by normal source monitor.

F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes adjustable.

G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, unloaded operation.

H. Operating transfer time of the switch in either direction shall not be greater than 1/6 of a second.

I. Program 'Life Safety' Loads to energize prior to energizing 'Critical' Loads.

2.04 ACCESSORIES

- A. Manual Operator: Provide manual operator to allow switch to be operated under no-load conditions from behind a barrier partition or with the door closed.
- B. Indicating Lights: LED type. Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.
- C. Test Switch: Mount in cover of enclosure to simulate failure of normal source by interrupting the power signal to the normal source monitor.
- D. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
- E. Transfer Switch Auxiliary Contacts: Minimum 2 normally open; 2 normally closed.
- F. Normal Source Monitor: Monitor each line of normal source voltage; adjustable set points; initiate transfer when voltage drops below 85 percent.
- G. Alternate Source Monitor: Monitor alternate source voltage and frequency; adjustable set points; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 Hertz from rated nominal voltage.
- H. The switch shall contain an in-phase monitor or adjustable time delay transition to inhibit closing of the switch into high levels of motor residual voltage.
- I. A factory installed equipment ground bar shall be provided in each switch enclosure.
- J. Two-pole transfer switches shall contain a factory installed fully rated solid neutral lug assembly.
- K. Provide digital metering on all transfer switches 200A and larger. Metering shall provide, at a minimum, measurement of voltage, current and kW demand for each phase on the load side of the switch.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install according to manufacturer's instructions.

B. Starting contacts for all transfer switches shall be wired in parallel to the generator starting circuit so that any transfer switch that senses a loss of normal power will start the generator. This control wiring is not shown on the plans but is required to be provided by the electrical contractor.

3.02 FIELD ADJUSTMENTS

A. The contractor shall field adjust all timing and voltage settings of the transfer switch as necessary for proper operation of the switch, related loads and sources.

3.03 AGENCY TRAINING

A. Provide factory training to Department of Transportation maintenance department (minimum of 2 hours).

END OF SECTION 26 36 23

SECTION 26 43 13 – SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section includes Surge Protective Devices (SPD) as indicated on the project drawings and electrical diagrams.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 REFERENCE STANDARDS

UL 1449, Third Edition – Standard For Safety For Surge Protective Devices.

ANSI/IEEE C62.41.1 Guide on the Surge Environment in Low-Voltage AC Power Circuits.

ANSI/IEEE C62.41.2 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

ANSI/IEEE C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits.

IEEE C62.62 Standard Test Specification for Surge Protective Devices For Low-Voltage AC Power Circuits.

NFPA 70, NEC Article 285

1.04 QUALITY ASSURANCE

A. The manufacturer shall have been in the Surge Protective Device industry for a minimum of 5 years.

1.05 WARRANTY

A. The manufacturer shall provide a minimum 5 year warranty from the date of shipment of the SPD.

1.06 SUBMITTALS

A. Include all SPD data necessary to show device is in compliance with all product specifications. Include product data sheets showing the device performance, dimensions, weight, connections, and mounting requirements, along with installation instructions.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 SURGE PROTECTIVE DEVICES

A. The SPD shall be Listed according to UL 1449, Third Edition. The product and ratings shall be included in the database of the UL.com web site.

B. The surge protective device (SPD) shall be designated a location Type 1 or Type 2 device intended for installation on the load side of the service equipment overcurrent device, including SPDs located at the branch panel.

C. The SPD shall be connected in parallel with the facility's electrical system.

D. The SPD shall be made up of metal oxide varistors (MOV's), or a combination of MOV's with selenium cells or silicon avalanche diodes, ensuring that all of the performance requirements are met. Gas tubes shall not be used.

E. The entire SPD shall be enclosed in a metal or ABS enclosure, NEMA rated for the location. SPDs at main service equipment shall be mounted outside the Main Distribution Panelboard (MDP) (not integral to, or installed within the panelboard).

F. The SPD shall have a maximum continuous operating voltage (MCOV) rating not less than 115% of nominal voltage of the system it is protecting.

G. Protection Modes:

1. The SPD shall have line to neutral (L-N), line to ground (L-G), line to line (L-L) and neutral to ground (N-G) protection modes for grounded wye configured systems. For a delta configured system, the device shall have line to line (L-L) and line to ground (L-G) protection modes.

H. Voltage Protection Rating (VPR):

1. The UL 1449 Voltage Protection Rating (VPR) for the device shall not exceed the following:

2. 240/120 volt applications: 900V L-N, L-G, N-G; 1200V L-L

- I. Nominal Discharge Current (In):
 - 1. The SPD shall have a UL 1449 Nominal Discharge Current Rating (In) of not less than 20kA.
- J. Short Circuit Current Rating (SCCR):
 - 1. The SPD shall have a UL 1449 Short Circuit Current Rating (SCCR) of not less than 230kA.
- K. Surge Current Rating:
 - 1. The single-pulse (8 X 20 microsecond waveform as specified in ANSI/IEEE Standard C62.41) surge current capacity shall not be less than the following:
 - a. 100 kA per mode for service entrance, switchboard, and main distribution panel locations
 - b. 50 kA per mode for branch panelboard (2nd tier) locations
- L. Electrical Noise Filtering:
 - 1. The SPD shall contain a high performance EMI/RFI noise rejection filter.
- M. Each SPD shall include externally-mounted LED visual status indicators that indicate the on-line status of the unit, for each phase.
- N. Each SPD shall be provided with audible diagnostic monitoring by way of audible alarm with on/off silence function.
- O. Each SPD shall be provided with one set of NO/NC dry contacts for alarm conditions.

PART 3 - EXECUTION

301 INSTALLATION

- A. Install SPD units according to manufacturer's written instructions, applicable requirements of NEC and NEMA standards, and recognized industry practices.
- B. The SPD units shall be installed at the locations shown on the drawings, or as indicated in the one-line diagram. They shall be parallel-connected to, and located adjacent to the switchboard or panelboard being protected. Locate as close as practical to the bus, keeping lead length as short as possible (less than 3 feet preferred).

C. SPDs shall be connected through a multi-pole circuit breaker or fused disconnect switch, not into main lugs. Circuit breaker or fused disconnect switch shall be 60A for main service device, 30A for branch panelboard device or as recommended by the manufacturer.

D. Use schedule 40 PVC conduit or metallic conduit between the SPD and the switchboard or panelboard as recommended by the manufacturer. Avoid sharp bends, excess length, and splices in the wires. Where possible, use a close-nippled connection with wires going directly to a circuit breaker within the switchboard or panelboard.

E. Setup and test per the manufacturer's recommendations.

END OF SECTION 26 43 13

SECTION 26 51 13 – INTERIOR LIGHTING FIXTURES, LAMPS AND BALLASTS

PART 1 - GENERAL

1.02 SCOPE

A. The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts.

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.04 SUBMITTALS

A. Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance data for each luminaire type.

B. For each luminaire type, submit luminaire information in the following example table format, and submit catalog cuts with highlighted catalog numbers and required accessories.

<u>Luminaire</u>		<u>Ballast</u>	<u>Lamp</u>	<u>ANSI Input Watts</u>
Type	Manufacturer and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	

1.05 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 INTERIOR LUMINAIRES AND ACCESSORIES

A. See the Lighting Fixture Schedule on the drawings, for type of fixtures and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Fixtures manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated fixtures, and meet the intent of the design.

B. Provide fluorescent fixtures with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

C. Fluorescent T8 lamps and ballasts shall be listed on CEE high-performance qualifying product list and approved by Focus-On-Energy.

2.02 LAMPS

A. Four Foot Fluorescent Lamps: High Performance T8 Lamps:

1. Minimum 3000 initial lumens and minimum of 2820 mean lumens.
2. Minimum 24,000 hour rated life at three-hour starts.
3. Color Rendering Index (CRI) of 81 or higher.
4. 4100°K color temperature.
5. Lamps shall be suitable for use with instant start ballasts and occupancy sensors.
6. Lamps shall meet "TLCP" requirements for low mercury.
7. Mean system efficiency equal to 90MLPW minimum, with instant start ballasts.

B. Acceptable lamp manufacturers and catalog numbers are (or equal):

1. PHILIPS - F32T8/ADV84/ALTO
2. GE - F32T8/XL/SPX50/HL/ECO
3. SYLVANIA - F032/841/XPS/ECO3
4. SLI LIGHTING - F32T8/HL/841
5. STANDARD PRODUCTS - F32T8/841/XL31
6. MAXLITE - F32T8/841XL
7. TECHNICAL CONSUMER PRODUCTS, INC. - F32T8/841/HL

C. Manufacturer names and catalog numbers are used to develop quality and performance requirements only. Lamps manufactured by others will be accepted provided they meet or exceed the specifications.

D. All lamps shall be new.

2.03 FLUORESCENT BALLASTS

A. All fluorescent ballasts shall be electronic type and shall meet the following specs:

1. UL Listed (Class P) sound rating A and CSA certified.
2. Comply with EMI and RFI limits set by the FCC (CFR 47 part 18) or NEMA and not interfere with normal electrical equipment.
3. Meet any applicable standards set forth by ANSI.
4. Be potted or conformal coated in a metallic case and not contain PCBs.
5. Provide normal rated lamp life as stated by lamp manufacturers (i.e. rated life at 3 hour burn time per start).
6. Provide independent test results from an approved testing laboratory for all of the specifications below. This is required for all submitted ballasts.

7. Nominal power factor of .90 or higher.
8. Total harmonic distortion of less than 10% at 120 or 277 volts (universal voltage).
9. Ballast factor 0.70 through 1.2, as shown on the lighting fixture schedule.
10. Frequency of operation shall be 40 kHz - 50 kHz and units shall operate without visible flicker.
11. Ballast efficiency factor shall meet Consortium of Energy Efficiency (www.cee1.org) specifications (adopted by Focus on Energy program).
12. Multi-lamp ballasts shall operate in parallel so that when one lamp burns out, the other lamps will continue to operate at full light output.
13. Ballast Efficiency Factor (BEF) shall be as shown in the table below.

Number of Lamps	Low (BF $\leq$ 0.85)	Normal (0.85 < BF $\leq$ 1)	High (BF > 1.0)
INSTANT – START BALLASTS (T8 lamps)			
1	≥ 3.08	≥ 3.11	N.A.
2	≥ 1.60	≥ 1.58	≥ 1.55
3	≥ 1.04	≥ 1.05	≥ 1.04
4	≥ 0.79	≥ 0.80	≥ 0.77
PROGRAMMED – START BALLASTS (T5 lamps)			
1	≥ 2.85	≥ 2.84	N.A.
2	≥ 1.48	≥ 1.47	≥ 1.51
3	≥ 0.97	≥ 1.00	≥ 1.00
4	≥ 0.76	≥ 0.75	≥ 0.75

14. Ballasts shall carry a minimum 5 year warranty with a \$10 replacement labor allowance.
15. Ballasts shall not be affected by lamp failure.
16. Ballasts shall be a standard production item.
17. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL Listing.
18. Ballasts shall withstand line transients as defined in IEEE 587, Category A.
19. **SYSTEM PERFORMANCE:** System performance for instant-start ballasts shall be as follows:
 - a. Instant-Start, Low Ballast Factor (BF = 0.77-0.78)

Lamps	Nominal Lamp Watts	System Input (Watts @ Univ Volt)
1 – F32T8	32	25
2 – F32T8	32	48
3 – F32T8	32	73
4 – F32T8	32	97

- b. Instant-Start, Normal Ballast Factor (BF = 0.87-0.88)

Lamps	Nominal Lamp Watts	System Input (Watts @ Univ Volt)
1 – F32T8	32	28
2 – F32T8	32	56
3 – F32T8	32	83
4 – F32T8	32	109

20. SYSTEM PERFORMANCE: System performance for programmed-start ballasts shall be as follows:

- a. Programmed-Start, Low Ballast Factor (BF = 0.71)

Lamps	Nominal Lamp Watts	System Input (Watts @ Univ Volt)
1 – F32T8	32	25
2 – F32T8	32	47
3 – F32T8	32	73
4 – F32T8	32	93

- b. Programmed-Start, Normal Ballast Factor (BF = 0.88)

Lamps	Nominal Lamp Watts	System Input (Watts @ Univ Volt)
1 – F32T8	32	31
2 – F32T8	32	60
3 – F32T8	32	88
4 – F32T8	32	118

B. Acceptable ballast manufacturer's names and product lines are as follows:

1. Osram Sylvania – Quicktronic High Efficiency and Quicktronic PROstart.
2. GE Lighting – Ultramax and UltraStart.
3. Maxlite – High Efficiency Ballast.
4. Advance – Optanium.
5. Universal Lighting Technologies – F32T8.

C. Manufacturer names are used to develop quality and performance requirements only. All manufacturers and their products shall meet the system performance requirements and this entire specification.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install according to manufacturer's instructions.
- B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Heavy duty jack chain supports may be used where indicated on the fixture schedule. Provide pendant or chain length required to suspend luminaire at indicated height.
- C. Support luminaires larger than 2 x 4 foot (600 x 1 200 mm) size independent of ceiling framing.
- D. Locate ceiling luminaires as indicated on reflected ceiling plan.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- F. The Contractor shall install fixture supports as required. Fixture installations with fixtures supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all lighting fixtures adequately, providing extra steel work for the support of fixtures if required. Any components necessary for mounting fixtures shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.
- G. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide independent support for all fixtures over 50 lbs.
- H. Install recessed luminaires to permit removal from below.
- I. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- J. Install code required hardware to secure recessed grid-supported luminaires in place.
- K. Install wall mounted luminaires and exit signs at height as scheduled.
- L. Install accessories furnished with each luminaire.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.

O. Install specified lamps in each luminaire and exit sign.

P. All lamps shall be delivered to the job in sealed cartons and protected from dirt and dust during storage on the project. Lamps shall be taken directly from the cartons and installed in the fixture with special care so that they do not become dusty and are not soiled in the operation.

Q. All new lamps shall be operational at the Substantial Completion of the project.

3.02 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.

C. Touch up luminaire finish at completion of work.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Interface with air handling accessories furnished and installed under Division 23.

3.04 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.05 ALL FIXTURE CONNECTIONS INCLUDING MASTER-SLAVE

A. Direct box or conduit connections for surface and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Flexible metal conduit shall be minimum 3/8" (10 mm) minimum diameter and six foot (1.8 M) maximum length. Conduit length shall allow movement of the fixture for maintenance purposes.

B. The flexible connectors shall be all steel, galvanized, clamp type with locknut or snap-in connector.

END OF SECTION 26 51 13

SECTION 26-51-15 – LIGHTING CONTROLS DEVICES

PART 1 - GENERAL

1.01 SCOPE

- A. Provide and install all automatic lighting controls as shown on the Drawings and as specified within.
- B. Model numbers on the Drawings take precedence over model numbers listed in this specification.

1.02 SHOP DRAWINGS

- A. Required.
- B. Provide manufacturer's standard literature for each project proposed for the project.

1.03 SPECIAL PROJECT CONDITIONS

- A. All wall-mounted occupancy sensors for this project shall match color of electrical devices.

PART 2 - PRODUCTS

2.01 WALL-MOUNTED OCCUPANCY SENSORS – SINGLE RELAY

- A. Hubbell Model #LHMTS1I.
 - 1. Equal products by Wattstopper, Novitas, Leviton or Uenco are acceptable.
- B. Switch mounts in standard single gang electrical box, or may be gang-mounted with additional decorator-type electrical devices.
- C. Switch works on infrared sensing only.
- D. 800 watts load rating with incandescent or fluorescent loads (using magnetic or electronic ballasts).
- E. Adjustable time delay form 15 sec. up to 30 minutes.
- F. Field-adjustable sensitivity and light level.
- G. 180 degree coverage up to 10 feet in radius.

2.02 WALL-MOUNTED OCCUPANCY SENSORS – DUAL RELAY

- A. Wattstopper model LHMTD2I
 - 1. Equal products by Wattstopper, Mytech, Leviton, Novitas or Uneco are acceptable.
- B. Switch mounts in a standard single-gang electrical box, or may be gang-mounted with additional decorator-type electrical devices.
- C. Passive infrared dual relay (Dual-switching) wall switch
- D. 120/277 VAC, 800 watts load rating
- E. Time delays: Fixed (5, 10, 15, 20, 25, or 30) walk-thru test mode.

2.03 CEILING-MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSORS

- A. Based on products by Hubbell.
 - 1. Equal products by Wattstopper, Mytech or Novitas and Leviton are acceptable.
- B. Sensor shall be Hubbell Model OMNI DT 2000.
- C. Power pack shall be Hubbell Model UVPP.
- D. Sensor mounts over a standard octagon box, or may be supported independently on a suspended ceiling system.
- E. Power pack mounts to a standard electrical box using knockout to separate low voltage from high voltage.
- F. Include low voltage sensor wiring. 3-conductor, #18 AWG minimum, with overall non-shielded jacket, plenum-rated where located in air-return plenums.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Mount automatic controls where shown on the Drawings. Ceiling-mounted sensors shall be coordinated with lighting, HVAC diffusers/grilles, etc.
- B. Make all wiring connections per manufacturer direction.

C. At completion of installation, adjust light level and sensitivity as needed for proper operation.

3.02 90 DAY RE-ADJUSTMENT

A. After 90 days of “normal” use by the Owner, this contractor shall re-adjust the sensitivity, lighting levels and devices locations as necessary for proper and acceptable operation.

END SECTION 26-09-23

END OF DIVISION 26 - ELECTRICAL

DIVISION 27 – COMMUNICATIONS

SECTION 27 00 00 – COMMUNICATIONS CABLE AND EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

A. This section describes the products and execution requirements relating to furnishing and installation of Telecommunications Cabling and Termination Components and related sub-systems as part of a Structured Cabling System at the new building and location Backbone and Horizontal Station cabling comprised of Copper, and Fiber-Optic are covered under this document.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1. Section 26 05 00 – Common Work Results For Electrical
2. Section 26 05 33 – Raceway and Boxes for Electrical Systems
3. Section 26 05 36 – Cable Trays For Electrical Systems
4. Section 26 27 26 – Wiring Devices
5. Section 26 05 06 – Grounding and Bonding for Electrical Systems
6. Section 26 05 29 – Equipment Connections and Coordination
7. Section 26 05 53 – Identification for Electrical Systems

1.03 REGULATORY REFERENCES

A All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Wisconsin Electrical Code and present manufacturing standards.

B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. Other applicable standards are as follows:

1. ANSI/IEEE C2 - National Electrical Safety Code
2. NFPA 70- 2002 - National Electrical Code
3. DILHR Chapter 16 - Wisconsin Electrical Code
4. TIA/EIA Standards 526-14A (OFSPT-14A), 526-7 (OFSPT-7), 568B.1 (Category 6e), 568B.2 (Category 6), 568B.3, 569A, 606A, and 607 (with exception)

5. IEEE/ANSI 142-1982 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
6. ICEA publication S-80-576-2002

1.04 DESIGN INTENT

- A. The Horizontal (Station) Cabling System is based on the installation of 4-Pair Unshielded Twisted Pair (UTP) DATA Category 6e and 4-Pair UTP VOICE Category 6e Copper Cables. The cables shall be installed from the Telecommunications Room (TR) serving that area and terminated as specified in this document.
- B. Station cables shall be installed in conduit, free air, cable tray. Outlets shall be mounted flush on a wall-mounted box. Information Outlet locations are to be identified on Project Drawings.
- C. At the Hub Room: Data, and IP Phone cable terminations shall be mounted on freestanding equipment racks; (as indicated on the drawings) termination hardware related to Data and Voice Cabling shall be rack mounted.
- D. All cables and related termination, support and grounding hardware, bonding, shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in the following section[s].
- E. The Contractor shall provide all labor and materials necessary to construct the system as described herein. This includes - but is not limited to - furnishing and installing cable, cable supports, racking and termination components, termination, testing, labeling and documentation.

1.05 WORK SEQUENCE

- A. During the construction period, coordinate telecommunications schedule and operations with the Architect, Engineer and General Contractor.

1.06 SUBMITTALS

- A. Under the provisions of Section 26 05 00 and Division 1, prior to the start of work the Contractor shall submit:
- B. Six (6) sets of Manufacturer's Data covering all products proposed indicating construction, materials, ratings and all other parameters identified in Part 2 (Products) below.
- C. Manufacturer's installation instructions.

D. Submittals should be grouped to include complete documentation of related systems, products and accessories in a single submittal. Where applicable, dimensions should be marked in units to match those specified.

E. Submittals shall be original catalog sheets, photocopies, or electronic format (ADOBE Portable Document format “.pdf”) thereof. Facsimile (fax) sheets shall not be accepted.

F. Two sets of submittals. The engineer shall review the Submittals and annotate them indicating approvals and shall return to the contractor.

G. Work shall not proceed without the engineer’s approval of the submitted items.

H. If materials are furnished as specified no further qualifications is necessary, except for items requiring shop drawings. However, if the Contractor wishes to substitute another manufacturer and/or catalog number, the following information in triplicate shall be submitted to the engineer:

1. A complete description of the material which the contractor proposes to substitute (shop drawings, illustrations, catalog data, performance characteristics, etc.) and the reason for the substitution identifying any benefit to the Owner.

I. The Contractor shall receive approval from the engineer on all substitutions of material. No substituted materials shall be installed except by written approval from the engineer.

1.07 PROJECT RECORD DOCUMENTS

A. Submit and record documents under provisions of 26 05 00.

B. Accurately record exact sizes, locations and quantities of cables.

1.08 QUALITY ASSURANCE

A. The manufacturer shall be a company specializing in communication cable and/or accessories with a minimum of five years documented experience in producing cable and/or accessories similar to those specified below.

B. The contractor shall have been in this line of business for a minimum of five (5) years and completed four (4) jobs of the magnitude specified in the following sections.

C. The installing contractor shall have at a minimum one (1) Certified Installer trained to the latest industry standards to ensure the most reliable installation available. The Certified Installer shall have been trained by a company(s) that offer a minimum fifteen (15) year system warranty.

1.09 DELIVERY, STORAGE AND HANDLING

A. Cable shall be stored according to manufacturer's recommendations as minimum. In addition, cable must be stored in a location protected from vandalism and weather.

B. If the contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner. If necessary, cable shall be stored off site at the contractor's expense.

1.10 DRAWINGS

A. It shall be understood that the electrical and telecommunication details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the Contractor in bidding the job. The Contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

C. Prior to submitting the bid, the Contractor shall call the attention of the engineer to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted, within ten (10) days prior to the Bid Due Date.

PART 2 - PRODUCTS

2.01 INFORMATION OUTLET

A. Station cables shall each be terminated at their designated workstation location in the connector types described in the sub-sections below. Included are modular jacks (Voice & Data) assemblies. These connector assemblies shall snap into a mounting frame. All ports shall be installed such that the opening faces the floor. The combined assembly is referred to as the Standard Information Outlet (SIO).

1. SIO mounting configurations shall be as follows:
 - a. All data/voice jacks shall be flush mounted.

2. The Telecommunications Outlet Frame shall accommodate: A minimum of two (2), when installed on a wall-mounted assembly. The outlet frame shall incorporate a mechanism for adjusting the surface plate to a plumb position.

B. Multiple Jacks - identified in close proximity on the drawings (and not separated by a physical barrier) - may be combined in a single assembly. The contractor shall be responsible for determining the optimum compliant configuration based on the products proposed and documenting these in the as-built records.

C. The same orientation and positioning of Jacks and Connectors shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each SIO type for review by the engineer.

D. Wall Mount Outlet Faceplates shall incorporate identifying labels.

E. Where stand-alone "Data" or "Voice" only Jacks are identified, the SIO Frame shall be configured as to allow for the addition of one (1) additional jack (Voice or Data) to be installed to supplement each such jack as defined by this project. The installation of these supplemental Jacks IS NOT part of this project.

F. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

G. The faceplate of the SIO shall be constructed of High Impact Plastic. Faceplate color shall match wiring device.

H. Wall-mounted "Voice Only" outlets shall be installed where identified on the Floorplan Drawings to accommodate wall-mounted telephone sets. The Wall Plate shall be of Stainless Steel construction, accommodate one (1) voice jack as defined below, mount on a standard single gang outlet box or bracket and include mating lugs for wall phone mounting.

I. All Standard Information Outlets and the associated Jacks shall be of the same manufacturer throughout the project. An allowable exception, however, is the Wall-mounted "Voice Only" Outlet described above.

2.02 DATA AND VOICE JACKS

A. Data and Voice jacks shall be an 8-pin Modular Jack.

B. The interface between the jack and the station cable shall be a 110-Style block or insulation displacement type contact. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination

C. Data Jacks shall be pinned TIA-568B with the pairs as follows:

D. Voice Jacks shall be pinned TIA-568B with the pairs as follows:

1. TIA-568B: Pair 1 - Pins 5 & 4
2. Pair 2 - Pins 1 & 2
3. Pair 3 - Pins 3 & 6
4. Pair 4 - Pins 7 & 8

E. Transmission characteristics of the Data and Voice Jack shall be as required to meet the TIA/EIA Category 6e performance criteria. Refer to the Execution Section which details the required performance criteria of the completed Link of which the Jacks are a part.

F. The Jack shall be UL verified and listed.

G. Jack contacts shall have a minimum of 50 micro-inches of gold plating.

H. The color of the Data Jack shall be blue. Where used for another application a color unique from the data and voice jack shall be used. Alternately, a color-coded Bezel or Icon may be used to identify the Data and Voice Jack.

I. The Color of the Voice Jack shall be Electric Ivory.

2.03 WALL-MOUNT VOICE-ONLY OUTLETS

A. Wall mounted "voice Only" outlets shall be installed where identified ("W") on the Project Drawing(s) to accommodate wall-mounted telephone sets. The Wall Plate shall be of Stainless Steel construction, accommodate one (1) voice jack as previously defined, mounted on a standard single gang outlet box or bracket and include mating lugs for wall phone mounting.

2.04 DATA PATCH PANEL

A. Data cabling shall be terminated at the Hub Room and Telecommunications Hub Room on panels incorporating Modular Jacks meeting the specifications for the Telecommunications Outlet detailed in the Section above.

B. At the Telecomm Room #116, these panels shall be rack mounted.

C. The Data Patch Panel shall consist of a Modular to 110-type connector system. Modular jacks shall meet the specifications detailed above (NON-KEYED 8-pin).

D. The largest single patch panel configuration shall not exceed 48 ports. Panels which are modular shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12-jacks. High density patch panel configurations must incorporate horizontal cable management systems sized to accommodate the quantity of patch panel jacks being installed.

E. The Patch Panel blocks shall have the ability to seat and cut 8 conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Data blocks shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.

R. The Data Patch Panel as a system (including jack, cable interface and intermediate components) must maintain Category 6e performance per the referenced TIA/EIA documents. All pair combinations must be considered, with the worst-case measurement being the basis for compliance.

G. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

H. The Patch Panel shall have color coded designation strips to identify cable count.

I. Transmission performance shall be maintained by the Data Patch Panel as a system (including jack, cable interface and intermediate components).

2.05 IP VOICE BACKBONE TERMINATION FIELD

A. A. At the Telecommunication Hub Room #116 each Voice "Backbone" Cable shall be terminated on 110 style blocks.

B. B. Each horizontal row of the cross-connect block must be capable of terminating one (1) twenty-five pair binder group (Backbone Cables). Backbone blocks shall be segregated clearly identifying their function.

C. The mechanical termination shall:

1. Have the ability of terminating 22 - 26 AWG plastic insulated, solid and stranded copper conductors.
2. Provide a direct connection between the cable and jumper wires.
3. Have less than 0.2-dB of attenuation from 1 - 16 MHz.
4. Have less than 100 milli-Ohm of DC resistance.
5. Have less than 5 milli-Ohm of resistance imbalance.
6. Have minimal signal impairments at all frequencies up to 16 MHz.

D. Blocks shall identify pair position by a color designation - Blue, Orange, Green, Brown and Slate (Backbone only)

E. The blocks shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.

F. The Voice Termination Hardware shall be 110-style.

1. Voice Backbone Cabling Termination
2. Five (5) Pair Termination Clips (e.g. C5) shall be used in the termination of Voice
3. Backbone Cabling

G. Horizontal Troughs incorporating plastic distribution rings shall be provided by the Contractor to accommodate routing of jumpers. Troughs shall be positioned at the top of each column of termination blocks and between each 100-pair wiring block.

H. Vertical Troughs incorporating metal distributing rings shall be provided in the Entrance Room for vertical routing of jumper and/or cross-connect wire. In each telecommunication room, a backboard incorporating plastic distribution rings allowing for a change in direction in cross connect wiring shall be installed between the blocks on which station and backbone cabling are terminated.]

2.06 EQUIPMENT RACKS (Two Required)

A. Free Standing Equipment Rack At the Telecommunication Hub Room #116. Equipment Racks shall be furnished and installed by the contractor to house Cable Termination components (e.g. Copper Data/voice) and Network Electronics (by others). Refer to Part 3 ("Execution") of this Section for quantities required at each location.

1. The rack shall conform to the following requirements:
2. The rack shall comply with State Building Codes for the seismic area in which it is to be installed.
3. Rack shall be 4 post-type, 84" in height and shall be self-supporting.
4. Channel uprights shall be spaced to accommodate Industry standard 19" mounting.
5. Rack must be constructed of aluminum and have either a coating or painted surface.
6. Rack shall be double-side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per EIA/TIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets
7. Rack should be supplied with a supply of spare screws (minimum of 24).
8. Base footprint should be no smaller than 15"x20".
9. Rack should be supplied with a ground bar and #6 AWG Ground lug.

B. Jumper Management Rack shall be equipped with Vertical and Horizontal Jumper Management Hardware in the form of rings and guides, as to allow an orderly routing of twisted pair, optical fiber and coaxial jumpers from the patch panels to the customer provided network equipment. Jumper management hardware shall be as follows:

1. Horizontal Jumper Management
 - a. Panels shall be plastic (3.5" panel), have a minimum of five (5) Jumper distribution rings (1.75" x 3.75" minimum dimension) and incorporate jumper routing clips (plastic) for individual jumpers.
 - b. At minimum, horizontal cable management hardware shall be positioned above and below (a) each grouping of two rows of Jacks Data Patch Panels, (b) each grouping of two rows of "F" connectors on Coaxial Patch Panels.

2. Vertical jumper management
 - a. Shall provide for cable routing on front and rear of each rack and be 3 1/2" square (minimum). Vertical Jumper Management hardware shall mount on spacers attached to the rack uprights and not on the upright itself. Where multiple racks are to be installed, this hardware shall be mounted between the uprights of adjacent racks. Rack uprights and the spacers shall be secured together per manufacturer recommendations.
 - b. Each rack shall be supplied with a minimum of 12 releasable (e.g. "hook & loop") cable support ties.

C. NOTE: Where Cable Termination Hardware is wall mounted, the contractor shall be responsible for establishing a cable pathway for jumpers routed from the Equipment Rack(s) to the wall. This shall be in the form of slotted ducts, troughs, "D" rings or other means. The proposed method shall be included in the submittals required by this document and shall be approved by the engineer prior to installation.

2.07 MISCELLANEOUS MATERIALS

A. Voice Station Patch Cords

1. The contractor is to furnish voice station patch cords which are six inches or less in length and consist of an 8P8C plug (pinned 568B) and connected to an 8P8C jack with Category 6e cable.
2. The Contractor is to furnish data station CAT6 patch cords, length as required between wall mounted data jack and counter-top "flip-up" jacks(s) in each office (if required).

B. Power Strip / Surge Suppressor

1. At each Equipment Rack, one (1) Power Strip / Surge Suppressor shall be furnished and installed by the contractor to provide for powering of the network electronics (by others).
2. Power Strip / Surge Suppressor shall:
 - a. be rack mountable (19-inch rack)
 - b. be compliant with UL-1449, UL 1283 and UL-497A.
 - c. provide Transient suppression to 13,000-A. Protection shall be in all 3 modes (hot-neutral, hot-ground & neutral-ground).
 - d. shall meet or exceed IEEE 587 Category A & B specification.
 - e. provide High Frequency Noise Suppression as follows:
 - f. >20-dB @ 50-kHz
 - g. >40-dB @ 150-kHz
 - h. >80-dB @ 1-MHz
 - i. >30-dB @ 6- to 1000-MHz

- j. provide a minimum of 320 Joules of AC Energy Absorption.
- k. be equipped with a 12-foot power cord
- l. provide a minimum of six outlets

2.08 TELECOMMUNICATIONS GROUND

A. At Telecommunications Room #116, a "Main Grounding Busbar (MGB)" shall be installed by the Electrical Contractor. Refer to Section 26 05 26 "Grounding and Bonding for Electrical Systems".

B. The telecommunication ground cable is to be an isolated grounding system pursuant to TIA/EIA 607 with the exception that the ground cable is not to be tied to building steel except at the electrical service entrance.

2.09 CABLE RUNWAY

A. Sometimes referred to as "Ladder Rack", Cable Runway is used for support and routing of cabling within a Telecommunications Equipment Room.

B. Construction: Rungs welded to tubular stringers.

C. Material: 0.065 inch thick steel

D. Stringer Height - 1.5 inches.

E. Rung Spacing - 9 inches on center.

F. Finish: Manufacturer's standard epoxy paint or baked-polyester powder coat.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor shall furnish and install all cables, connectors and equipment as shown on drawings and as specified above. It shall be noted that all cables shall be installed in continuous lengths from endpoint to endpoint. No splices shall be allowed unless noted otherwise.

B. Refer to Project Drawings which indicate the cable route via cable tray to follow and the termination location.

C. Beginning installation means contractor accepts existing conditions.

D. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include, but not limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge

and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices, which may move or wear in a manner to pose a hazard to the cable, shall not be used.

E. All cable shall be pulled by hand unless installation conditions require mechanical assistance.

F. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

G. Cable pulling shall be done according to cable manufacturer's recommendations and ANSI/IEEE C2 standards. Manufacturer's recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed. If any installed cable is kinked to a radius less than recommended dimension it shall be replaced by the contractor with no additional cost to the project.

H. All wiring shall be run in conduit from jack location to cable tray as designated on the floorplan(s). All cable shall be free of tension at both ends.

I. Avoid abrasion and other damage to cables during installation.

J. Pulling Lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

K. The Cable system will be tested and documented upon completion of the installation as defined in the Section below.

L. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

M. Should it be found by the engineer, that the materials or any portion thereof, furnished and installed under this contract, fail to comply with the specifications and drawings, with the respect or regard to the quality, amount of value of materials, appliances or labor used in the work, it shall be rejected and replaced by the Contractor and all work distributed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.

N. CABLE RUNWAY

1. Provide cable runway and accessories necessary for complete system.
2. Size and layout cable runway per project Drawings.

3. Brace to racks with support brackets made by runway or rack manufacturer and intended for this purpose. Method shall provide adequate clearance for use of cable dropouts and to maintain cable bends to greater than recommended minimums.
4. Brace to racks with support brackets made by runway or rack manufacturer intended for this purpose.
5. Use radius drops where cables drop from Cable Runway to Equipment Rack and at elevation changes of 6 inches or more.
6. Support per manufacturers recommendations. Maximum allowable deviation of runway from level horizontal plane measured across length of cable runway shall be 1/2 inch, with tray loaded to capacity.
7. Fasten cables to cable runway at intervals not to exceed 48 inches using hook and loop cable ties.

3.03 SYSTEM TOPOLOGY AND CABLE SIZE REQUIREMENTS

A. Station Cabling

1. Information Outlets cables with copper media (Voice & Data UTP) shall be located as detailed on the Project Drawings.
2. The Bidder in determining materials quantities and routing should utilize these documents.
3. Station Cabling shall be routed to the Telecommunications Room #116.
4. Station cables shall be run to the Information Outlet from the Telecommunications Room in conduit, in cable tray.
5. The maximum station cable drop length for Data and Voice UTP Category 6e shall not exceed 295-feet (90-meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing station cabling in a fashion as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the engineer prior to installation. Changes to the plan shall be approved by the engineer.
6. All cables shall be installed splice-free unless otherwise specified.
7. During pulling operation an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

8. Avoid abrasion and other damage to cables during installation.
9. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellom grips may be used to spread the strain over a longer length of cable.
10. Manufacturer's minimum bend radius specifications shall be observed in all instances.
11. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.
12. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
13. A coil of 4 feet in each cable shall be placed in the ceiling before the cables enter a conduit, surface raceway or box.
14. At all Telecommunication Rooms (TR) , approximately 10-feet of slack shall be left in each station cable under 250-feet in length to allow for changes in the telecommunication room layout without re-cabling. These "service loops" shall be secured to the ladder rack, with "J" hooks, or "D" rings above the equipment, racks, and patch panels and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
15. To reduce or eliminate EMI, the following minimum separation distances from $\leq 480V$ Power lines shall be adhered to:
 - a. Twelve (12) inches from power lines of $<5-kVa$.
 - b. Eighteen (18) inches from high voltage lighting (including fluorescent).
 - c. Thirty-nine (39) inches from transformers and motors.
16. All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.
17. **IMPORTANT:** Within the room in which Data Cabling is to be terminated, Hook and Loop (e.g. "Velcro") ties only shall be used from room entry to the point of termination. This is to facilitate the addition of future cables.

B. Information Outlet

1. Information Outlets shall be flush mounted on wall-mounted boxes.
2. Any outlets to be added where these conditions are not met shall be positioned at a height matching that of existing services or as directed otherwise by the Site Coordinator and the engineer. Nominal height (from finished floor to center line of Outlet) in new installation shall be as follows:
 - a. Standard Voice & Data Outlet 18-inches
 - b. Wall-Mounted Telephone Outlet 54-inches
(Standard Voice only)

3.03 CABLE TERMINATION

A. General

1. At the Telecommunications Rooms, all Data and Voice Cables shall be positioned on termination hardware in sequence of the Outlet I.D. starting with the lowest number. Exceptions to the sequencing of terminations is allowed only with the permission of the A/E.
2. Termination Hardware (Blocks and Patch Panels) Positioning and Layout must be reviewed and approved by the engineer prior to construction. The review does not exempt the Contractor from meeting any of the requirements stated in this document.

B. Cable Termination - Voice UTP

1. Voice pairs shall terminate on patch panels at the rack in the Telecommunication Room. The contractor shall coordinate the placement of patch panels with the engineer in order to integrate with other cabling.
2. Patch Panels shall be provided to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.
3. The contractor shall furnish and install cable management hardware (e.g. D Rings and cable guides) to neatly and securely route the cable to the cable termination hardware.
4. The Height of the Voice Termination Field shall not exceed 6-feet (72-inches) above floor level to facilitate cable maintenance.
5. Patch panels on which Station Cabling are terminated shall be positioned in separate columns. Backbone Cabling should be positioned to the Left; Station cabling to the Right and be in close proximity as to simplify installation and subsequent tracing of cross-connect wiring. Where new cabling is to be integrated

with existing cabling, it will be the responsibility of the Contractor, in cooperation with the Owner, to coordinate placement of Voice Termination hardware.

6. Cables shall be fed from below the Termination Hardware in a manner that will facilitate growth.

7. Horizontal Troughs incorporating split plastic distribution rings shall be provided by the Contractor to accommodate routing of jumpers. Troughs shall be positioned at the top of each column of termination blocks and between each 100-pair wiring block. Rings shall be positioned between the Backbone and Station blocks for vertical routing of jumpers and/or cross-connect wiring.

8. The installer shall ensure that the twists in each cable pair are preserved to within 1.0-inch of the termination for all Voice UTP cables and within 0.5-inch for Category 6e cables. The cable jacket shall be removed only to the extent required to make the termination.

C. Cable Termination - Data UTP

1. Data Patch Panels shall be designed and installed in a fashion as to allow future station cabling to be terminated on the panel without disruption to existing connections.

2. Data Patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.

3. At Information Outlets and Data Patch Panels, the installer shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for Data cables. The cable jacket shall be removed only to the extent required to make the termination.

D. Voice Cross Connects

1. The contractor shall be responsible for the "Cross-connect" wiring between the Station (horizontal) and Backbone Voice cabling.

2. Four (4) pairs in each station cable shall be cross-connected to the Backbone (riser or tie) cable. 4-pair Cross-connect wire, color coded to identify each pair, shall be used. The 25TH pair position of each riser voice block shall remain vacant.

3. Fastening cables directly to support brackets with wire or plastic ties will not be accepted. All cabling shall be neatly laced, dressed and supported.

4. The contractor shall be responsible for cross-connects between the cabling terminations at the Entrance Room and the SNI. It shall be the responsibility of the Contractor, to work with the Owner and Site Coordinator(s) and provide the necessary assistance to allow Owner and/or Telephone Company personnel to make the necessary connections to establish service on the new cable system. These activities include, but are not limited to cross connect documentation, general wiring overview and cable pair identification.

E. Equipment Racks

1. Equipment racks shall be furnished and installed in the following:

2. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. Rack shall also be stabilized by extending a brace extending to the ceiling if required. Alternately, overhead cable tray over which the cabling accesses the equipment rack(s) shall provide this function.

3. A space between the rack upright and the wall (~4") should be planned to allow for cabling in that area. The rear of the rack should be ~30" minimum from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed should be brought to the attention of the engineer for resolution prior to installation.

4. All hardware and equipment is to be mounted between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the engineer and Site Coordinator(s) prior to installation.

5. Equipment Rack shall be equipped with cable management hardware on both the front and back of rack as to allow an orderly and secure routing of twisted pair cabling to the data patch panels. At minimum, one such Horizontal Jumper Management Panel shall be installed by the Contractor..

6. The rack shall be grounded to the Telecommunications Ground Busbar (TGB) using a #4 AWG (or larger) insulated stranded copper conductor (GREEN jacket or GREEN jacket with one or more yellow stripes).

F. Identification and Labeling

1. Refer to Section 26 05 53 "Identification for Electrical Systems" for Identification and Labeling guidelines for this Project.

2. All Copper Station Cables, Outlet Faceplates and Termination components (e.g. Voice Field & Data Patch Panel) shall be clearly labeled.

3. Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used.

F. Work by Owner

1. NONE

G. Cooperation

1. The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost, provided such decision is reached prior to actual installation. The Contractor shall check the location of electrical outlets with respect to other installations before installing.

3.04 TESTING AND ACCEPTANCE

A. General

1. The contractor is responsible to perform acceptance tests as indicated below for each sub-system (e.g. backbone, station, etc.) as it is completed

2. All tests shall be documented.

3. The Contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type including equipment to use, set-up, test frequencies or wavelengths, results format, etc. The method of testing shall be approved by the engineer.

4. The Contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The contractor shall provide the engineer with a written certification that this inspection has been made

5. The Contractor shall conduct acceptance testing according to a schedule. The contractor shall provide a minimum of one (1) week advance notice to the engineer as to allow for such participation. The notification shall include a written description of the proposed conduct of the tests including copies of blank test result sheets to be used.

6. **IMPORTANT:** Failure to provide the above information shall be grounds for the Owner/Engineer to reject any and all Documentation of Results on related testing and to require a repeat of the affected test.

7. Tests related to connected equipment of others shall only be done with the permission and presence of Contractor involved. The Contractor shall ascertain that testing only as required to prove the wiring connections are correct.

8. The Contractor shall provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the engineer, the contractor shall provide copies of the original test results.

9. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the contractor. The applicable tests shall then be repeated.

10. Should it be found by the engineer that the materials or any portion thereof furnished and installed under this contract fail to comply with the specifications and drawings, with the respect or regard to the quality, amount of value of materials, appliances or labor used in the work, it shall be rejected and replaced by the Contractor and all work distributed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.

B. Voice Cabling (Copper UTP)

1. Backbone Cabling

a. Backbone Voice cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity and conductor position on the termination blocks (e.g. 110). Any mis-positioned pairs shall be identified and corrected. The percentage of "bad" pairs shall not exceed 3% in any Backbone (Riser or Tie) Cable based on total pair count. All bad pairs must be identified and documented.

2. Voice Station Cabling (Category 6e)

a. Testing shall be done from the voice jack at the SIO to the voice 110 blocks/patch panel at the TR where the cables are terminated. When the SIO is located on/in the wall behind modular furniture, a patch cord may be inserted into the SIO to allow the furniture to be returned to its normal location. Cat 6e cable testing, in this case, will be done with the patch cord. The cabling must pass all Cat 6e TIA requirements. If the cable test fails only due to the length of the patch cord, the owner will accept the cable as passing.

b. Horizontal "Station" cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and Wire Map

(Conductor Position on the Modular Jack). Any defective, split or mis-positioned pairs must be identified and corrected.

c. Testing of the Cabling Systems rated at TIA Category 6e shall be performed to confirm proper functioning and performance.

d. Where cross-connection of cabling sub-systems (e.g. Station & Backbone) by the Contractor is specified, each subsystem shall be tested separately as defined above followed by a Voice Channel Test after the cross-connection is complete.

3. Voice Channel

a. The end-to-end voice transmission between the building TR and the Standard Information Outlet (Voice) including patch cords/jumper cables.

4. Voice Channel Test

a. The contractor shall perform a voice channel test on all voice cable pairs from the Standard Information Outlet (Voice) to the pair appearance at the TR. All 4 pairs are to be free of shorts; verified for continuity, pair validity, polarity, and conductor position on the terminating blocks. Any mis-positioned pairs shall be identified and corrected. Any patch cords/jumper cables which cause the voice channel test to fail shall be replaced and the channel retested.

C. Data Station Cabling (Category 6e)

1. Testing shall be from the Jack at the SIO to the Data Patch Panel at the TR on which the cables are terminated. When the SIO is located on/in the wall behind modular furniture, a patch cord may be inserted into the SIO to allow the furniture to be returned to its normal location. Cat 6e cable testing, in this case, will be done with the patch cord. The cabling must pass all Cat 6e TIA requirements. If the cable test fails only due to the length of the patch cord, the owner will accept the cable as passing.

2. Horizontal "Station" cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and Wire Map (Conductor Position on the Modular Jack). Any defective, split or mis-positioned pairs must be identified and corrected.

3. Testing of the Cabling Systems rated at TIA Category 6e/ shall be performed to confirm proper functioning and performance.

D. Category 6e Performance Testing

1. "In addition to the above, Performance Testing shall be performed on all cables. Testing of the Transmission Performance of station cables (Category 6e) shall include the following:

- a. Length
- b. Attenuation
- c. Pair to Pair NEXT Loss (new limits)
- d. PSNEXT Loss
- e. Pair to Pair ELFEXT Loss (Equal Level Far End Cross-talk)
- f. PSEFEXT Loss
- g. Propagation Delay
- i. Delay Skew
- j. Return Loss

2. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission Performance Testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify "PASS" on each cable and display the specified parameters - comparing test values with standards based "templates" integral to the unit.

3. Category 6e testing shall be per ANSI/TIA/EIA 568B.1 Permanent Link test configurations and ANSI/TIA/EIA 568B.1 Category 6e.

4. The maximum length of station cable shall not exceed 90 meters which allows 10 meters for equipment and patch cables. Worst case performance at 20°C, based on a Horizontal Cable length of 90 meters and Equipment Cord length of 4 meters, shall be as follows:

E. Category 6e Test Parameters:

Category 6e Cable						
Permanent Link Test						
	TIA/EIA 568B.1	TIA/EIA 568B.1	TIA/EIA 568B.1	TIA/EIA 568B.1	TIA/EIA 568B.1	TIA/EIA 568B.1
	Insertion Loss	Next Pair to Pair	PSNEXT	ELFEXT	PSELFEXT	Return Loss
Frequency Attenuation	Coupling	Worst Case	Worst Pair to Loss	Worst Pair to Loss	Worst Pair to Loss	Pair Loss
Mhz	Max. dB	dB	DB	dB	dB	dB
1.00	2.1	>60.0	>57.0	58.6	55.6	19.0
4.00	3.9	54.8	51.8	46.6	43.6	19.0
8.00	5.5	50.0	47.0	40.6	37.5	19.0
10.00	6.2	48.5	45.5	38.6	35.6	19.0
16.00	7.9	45.2	42.2	34.5	31.5	19.0
20.00	8.9	43.7	40.7	32.6	29.6	19.0
25.00	10.0	42.1	39.1	30.7	27.7	18.0
31.25	11.2	40.5	37.5	28.7	25.7	17.1
62.50	16.2	35.7	32.7	22.7	19.7	14.1
100.00	21.0	32.3	29.3	18.6	15.6	12.0

F. Propagation Delay

1. The maximum propagation delay determined according to the TIA/EIA – 568B.1 for a Permanent Link configuration shall be less than 498-ns measured at 10MHz. (Note: In determining the permanent link propagation delay, the propagation delay contribution of connecting hardware is assumed to not exceed 2.5 ns from 1 MHz to 100MHz).

G. Delay Skew

1. The difference in propagation delay between the fastest and slowest pair in a cable shall not exceed the parameters below. Delay skew shall be measured according to annex D of ANSI/TIA/EIA-568-B.2.
Category 6e 44ns between 1 MHz and 100MHz

2. In order to establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an 8-position Category 6e Modular plug (8-pin) to facilitate testing. Net Propagation Velocity (NPV) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NPV data is available from the cable manufacturer for the exact cable type under test.

3. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacement and changes as are necessary, and shall then repeat the test or tests which disclosed faulty or defective material, equipment or installation method, and shall make additional tests as the engineer deems necessary at no additional expense to the project or user agency.

H. Shielded Cabling (T1) – Testing

1. Shielded "T1" Cables shall be free of conductor-to-conductor and conductor-to-shield shorts.

2. All pairs shall be verified for continuity, pair validity and polarity and conductor position on the termination blocks (e.g. 110). Any mis-positioned pairs must be identified and corrected, and retested again

3. Shield and Drain wire continuity shall also be verified.

3.05 DOCUMENTATION

A. General

1. Upon completion of the installation, the contractor shall provide three (3) full Documentation Sets to the engineer for approval. Documentation shall include the items detailed in the sub-sections below.
2. Documentation of Test Results shall be submitted in hard copy or in electronic form (preferred). Electronic documents may be submitted on CD-ROM (preferred) for review and distribution. Where documentation provided in electronic form requires unique software (other than an MS-Word compatible Word Processor or MS-Excel spreadsheet) for viewing test results, the Contractor shall provide along with the above documentation, one (1) licensed copy of such software. The software shall run on a MICROSOFT Windows-based personal computer supplied by the Owner.
3. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase.
4. The engineer may request that a 10% random field re-test be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

B. Test Data - Copper Media

- A. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
 1. Printouts generated for each cable by the wire test instrument (e.g. PentaScanner) shall be submitted as part of the documentation package. Alternately the contractor may furnish this information in electronic form on CD-ROM.

C. Cross-Connect Data

1. As noted above, it shall be the responsibility of the Contractor to work with the Owner and Site Coordinator(s) and provide the necessary assistance to allow Owner and/or Telephone Company personnel to make the necessary connections to establish telephone service on the new cable system. These activities include, but

are not limited to (1) a general wiring overview and (2) detailed cross connect documentation (relating SIO I.D., Room Number and Riser pair). The latter shall be in the form of an electronic format database (dBase, MS Excel or convertible format).

3.06 AS-BUILT CONSTRUCTION DRAWINGS

A. Drawings included with the specifications set shall be modified by the contractor to denote as-built information.

B. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

C. The Architect through the Consultant will provide floor plans in paper formats on which as-built construction information can be added. These documents will be modified accordingly by the contractor to denote as-built information as defined above and returned to the Consultant for acceptance. This information shall be supplied to the Consultant/Engineer no later than four (4) weeks prior to the scheduled occupancy of the affected floors.

D. The Contractors shall annotate the base drawings and return to the A/E in hard copy form.

E. Each drawing submitted by the Contractor as part of the Project Documentation shall be identified as an "As-built" drawing and include the following (1) The Contractor name and/or logo (2) The date of the drawing.

F. All documentation, including hard copy and electronic forms shall become the property of the owner.

3.07 WARRANTY

A. This Contractor shall guarantee all materials, equipment, etc., two (2) years from date of substantial completion of this work. This guarantee shall include all labor, material and travel time. See Division 1, GENERAL CONDITIONS, and GENERAL REQUIREMENTS - Guarantee Documents for further requirements.

END OF SECTION 27 00 00

SECTION 27 51 13 – PUBLIC ADDRESS SYSTEM

PART 1 - GENERAL

Applicable provisions of Division 1 shall apply to all work of this Section,

1.01 SCOPE

A. Provide two (3) -zones of paging within the building interfaced to new Telephone System located at Telecom Room #116. One zone is for the Inspection Bay #124 section of the building, second zone is for exterior speaker located at North-West corner of building and third zone is for an exterior speaker located on the South-West corner of building. The system shall be 70/25 Volts.

1.02 REFERENCE STANDARDS

- FCC Part 15 EMI Emission Standard
- FCC 47 CFR Part 68
- UL 1480 - General Signaling
- UL 6500 - Audio/Visual and Musical Instrument Apparatus for Household,
- Commercial and Similar General Use (IEC 60065)

1.03 RELATED WORK

- Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables
- Section 26 05 26 - Grounding and Bonding for Electrical Systems
- Section 26 05 33 - Raceway and Boxes for Electrical Systems
- Section 26 05 53 - Identification for Electrical Systems
- Section 27 00 00 - Communications Cable and Equipment

1.04 SUBMITTALS

- A. Provide Product Data for all cabling and equipment provided under this Section.
- B. Provide Shop Drawings including the following:
1. Cabling Diagrams - Single-line block diagrams showing cabling interconnection of all components. Identify cable type for each interconnection.
 2. Wiring Diagrams - Power, signal, and control wiring.
 3. Central Equipment Configuration Drawings - Dimensioned and to scale.
 4. Mounting requirements (box type, dimensions, etc.) for all components.

1.05 QUALITY ASSURANCE

- A Electrical Components, Devices, and Accessories shall be UL Listed.

B. Installer Qualifications:

1. Manufacturer's authorized representative for the products proposed. This authorization shall be in place at time of bidding and remain so throughout project.
2. Trained and approved for installation of units required for this Project.

C. Manufacturer Qualifications:

1. Experienced in manufacturing equipment similar to that indicated for this Project. Maintains technical support services capable of providing user with training, parts, and emergency maintenance and repair with a 24-hour-maximum response time.
2. Source Limitations: Obtain equipment components through one source from a single manufacturer.

1.06 WARRANTY

- A. Contractor shall guarantee all equipment, hardware, cabling, installation and workmanship for a period of one (1) year from date of substantial completion of this work.
- B. The product and materials warranty shall cover the full replacement or repair of defective products.
- C. Coverage shall include all parts, labor, travel and expenses.
- D. See Division 1, GENERAL CONDITIONS, and GENERAL REQUIREMENTS - Guarantee Documents for further requirements.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. General

1. The systems shall consist of a combination of interior and exterior speakers, rack-mounted telephone paging amplifier, power supply, rack-mounted paging zone modules, rack-mounted telephone interface module, rack-mounted paging control module, wall-mounted equipment rack and related cabling, pathway and mounting hardware. Refer to riser diagram on drawings for system layout.

B. System shall:

1. Be wired to support (3) paging zones per project drawings.
2. Be configured to serve (3) paging "zones."

- C. Have capacity to be expanded to serve (4) paging “zones.
- D. Paging Zone(s) shall be one-way. Each Paging Zone group shall be field-programmable.
- E. System shall be modular, allowing for serving of additional zones.
- F. Music input: Included.
- G. Telephone System Interface: Required.
- H. Night-Ringer: Included
- I. Active components shall be rack-mountable.

2.02 ACTIVE COMPONENTS

A. Amplifier (One required)

- 1. Rated Power Output: Main building paging amplifier shall be rated for 250 watts.
- 2. Rack-mounted Inputs for 600-ohm balanced telephone line, Lo-Z balanced microphone, and background music.
- 3. Music Input (RCA jack or screw terminals).
 - a. Integral automatic level control (ALC) circuit for controlling pages made by persons with varying voice levels and paging techniques.
- 4. Page from telephone and/or microphone.
- 5. Separate controls for page volume, music volume, night ringer, music mute, and Audio
 - a. Enhancement.
- 6. Base and Treble controls.
- 7. Built in night ringer activated by contact closure or by 90V ring signal.
- 8. Outputs: 25V and 70V.
- 9. Thermal and electronic overload protection.
- 10. Peak level indicator lights when amplifier is driven into clipping.
- 11. 120VAC, 60HZ power source.

12. Distortion: less than one percent.
 13. Regulation: 2dB
 14. Dimensions: 19"W x 10-1/2"H x 3-7/8" D.
- B. Inputs:
1. Microphone
 2. Telephone line (see below)
 3. AUX (High-impedance)
- C. Amplifier shall provide voltage and current (short term and continuous) as recommended by manufacturer for scope of project. Power supply shall be protected with re-settable circuit breaker(s).
- D. Amplifier shall operate from a 120 VAC, 60 Hz source, and shall be equipped with a resettable circuit breaker and thermal and electronic overload protection.
- E. Front panel indicators shall include:
1. Power On
 2. Peak level which illuminates when amplifier is driven into clipping.
- F. Include Equipment Rack Kit
- G. Manufacturer: Bogen, model #TPU250 or equal.
- H. Zone Paging System
1. One-zone to 99 zones of simultaneous high-power paging.
 2. Up to 32 paging zone groups.
 3. Universal telephone interface designed for direct connection to loop start and group start and ground start trunks, to PBX, or KEY paging ports which supply DTMF capability, and to analog T/R lines.
 4. Modular integration assures reconfiguring and expansion with minimum time and expense.
 5. Optional talkback paging and time-triggered signaling events with PCMTBM module.
 6. Field programmable using DTMF and DIP switches.

7. Signaling features include night ringer zone group, emergency/shift change zone group, code call zone group.
8. Emergency All-Facility Override Paging.
9. Background music assigned per zone; Local Background music sourcing capability.
10. Relay drivers and Aux contacts included.
11. Operating Voltage: 12VDC
12. Ringer Equivalence: 1.0 B
13. Audio Power Capability: 250 Watts.
14. Operating Current: 1.5 Amps.
15. Dimensions: 1-1/2" (Wide) x 7-1/2" (High) x 4-1/4" (Deep), (Each Module).
16. Daily master clock synchronization.
17. Includes: PCMCPU – Central Processor.
18. PCMTIM - Telephone Interface.
 - a. PCMZPM - Zone module (3-zones/module)
 - b. Manufacturer: Bogen, model #PCM2000.

2.03 EXTERIOR LOUDSPEAKER

A. General

1. Weatherproof metal construction.
2. 15 Watt power rating.
3. Excellent speech intelligibility.
4. Versatile 25/70 Volt Variable Tap Transformer.
5. Universal mounting bracket.
6. Double re-entrant type.
7. Frequency Response: 375 – 14,000 Hz.
8. Sensitivity: 110 dB @ 1000 Hz (1 watt at 1 meter)
9. Dispersion Angle: 100 degrees (radius)
10. Manufacturer: Telecor, model #A-15T

B. Interior Ceiling Speaker, Enclosure and Support:

1. SPEAKER:

- a. Speaker Diameter: 8".
- b. Power rating: 10Watts.
- c. Frequency Range: 50 Hz to 15,000 Hz.
- d. Magnet: 6 oz.
- e. Axial Sensitivity: 95 dB @ 4Ft. (1 watt input)
- f. Depth: 2-3/4"
- g. Transformer: Dual voltage (25/70).
- h. Secondary Taps: 4,2,1,1/2, and 1/4 watt.
- i. Secondary Impedance: 8 Ohms.
- j. Manufacturer: Telecor, model #S8T2570.

2. ENCLOSURE:

- a. Suitable for the surface installation of an 8" speaker/baffle assembly.
- b. Shall be suitable for ceiling and/or wall mount.
- c. Shall be an open frame, welded assembly, constructed of 18 gauge cold-rolled steel and finished with a mar-resistant, white semi-gloss, epoxy coating.
- d. Size: 12-13/16" square x 4" deep.
- e. Weight: 3-1/2 lbs.
- f. Manufacturer: Telecor, model #SH20.

3. BAFFLE:

- a. Type: Square, one-step contour.
- b. Finish: White, semi-gloss epoxy.
- c. Material: 22 gauge, cold-rolled steel.
- d. Size: 12-1/2" square, 3/16" deep.
- e. Weight: 24 Oz.
- f. Switch action: 3 position (privacy, Normal, Call) rocker switch, spring return from 'call' position.
- g. Manufacturer: Telecor, model #B25-S.

2.04 CABLE

A. Loudspeaker Cable

- 1. Per manufacturers recommendations for equipment and speaker type(s), cable length, etc.
- 2. Nominal - Speaker cable shall be 2-conductor, 18 AWG; overall shield.
- 3. Cable shall be listed CM or acceptable substitutes per NEC.
- 4. Refer to project drawings.

2.05 EQUIPMENT ENCLOSURE

A. Amplifier Rack-Mounted

B. Public Address and Closed Circuit Television (CCTV) Systems Equipment shall be mounted in a wall-mounted Equipment Rack.

C. Wall-mounted Equipment Rack.

1. Consists of backbox and cabinet.
2. Dimensions: 28.4" (deep) x 57.77" (High) x 23.06" (Wide)
3. Rack Units: 24U.
4. Include a lockable front door.
5. Include vented side panels.
6. Construction: 16 gauge welded steel
7. Color: Black
8. Include a 4U utility drawer in bottom of base.
9. Manufacturer: LOWELL, Model #LWBR-24-28, UDP-414

PART 3 - EXECUTION

A. General Installation

1. Install system according to manufacturer's recommendations.
2. Install system as a 70 Volt system.
3. Provide and configure amplifiers for the paging zone(s) as specified.
4. Adjust speaker taps and volume according to the locations of the environment in their location to provide distinguishable audibility upon announcements and balance volume throughout facility.
5. Coordinate with Agency maintenance staff to confirm paging system location and interface options.

B. Loudspeaker Installation

1. Provide speakers per project drawings.
2. Install surface on the ceiling and wall as noted on drawings. Provide all mounting hardware as recommended by loudspeaker manufacturer.

C. Cable Installation

1. All wiring shall be in conduit installed according to Section 26 05 00 “Common Work Results for Electrical”.
2. Size conduit per manufacturers recommendations or per project plans, whichever is larger.
3. Keep cables clear of other trades work.
4. Install cables splice-free unless otherwise specified.
5. Avoid abrasion and other damage to cables during installation. Visually inspect cables for cuts, blisters and abrasions during installation.
6. Terminate cabling at loudspeaker locations and at amplifier location(s).
7. Maintain continuity on cable shield and drain wire throughout each zone.

D. Labeling and Identification

1. Retain color-coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
2. Controls shall be permanently labeled to identify function.
3. Label amplifier and other switch settings determined during installation.
4. Label loudspeaker cables:
 - a. At each loudspeaker location cables with “IN” (from amplifier) or “OUT” (to next speaker) and Zone Identifier (e.g. number, letter, etc.).
 - b. At amplifier location cables with Zone Identifier (e.g. number, letter, etc.).
5. Comply with Section 26 05 53 “Identification for Electrical Systems”, Part 2 label product and format requirements.

E. Field Quality Control

1. Inspect installation to verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
2. At completion of installation, to check and test the system to verify that system is complete, operational and meets all requirements.
3. Adjust loudspeaker volume and system parameters (on a per zone basis, if applicable) per Owner instructions and to provide balanced coverage.

4. The Contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests.

F. Documentation

1. Operation and Maintenance Data: To include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Operating instructions.
 - b. Service manuals,
 - c. Troubleshooting guide.
 - d. Updated Wiring diagrams and terminal identification (as built).
 - e. Equipment parts list.
 - f. Current list of local manufacturer approved 24 hour service centers.
 - g. All Approved Submittals covering product data for types and sizes of wires and cables used.

G. Owner Training

1. General Training
 - a. Provide training for User Agency personnel on operation and maintenance of system and each component.
 - b. Training shall be complete to enable User Agency personnel to operate system and to perform maintenance and troubleshooting functions.
 - c. Conduct training during normal business hours after system start-up and Owner acceptance.
 - d. Training shall include hands-on exposure to the installed system.
2. Operational Training
 - a. Operational Training shall be provided for up to (2) staff.
 - b. Session shall be minimum 30-minutes and review:
 - 1) Overall system layout, equipment location and call station types.
 - 2) Zone assignments, Annunciator Panel Layout.
 - 3) Component operation
3. Maintenance Training
 - a. Maintenance Training shall be provided for up to (2) staff.
 - b. Session shall be minimum 1-hour and review content of Operational Training session plus:
 - c. Expanded detail of system layout including cabling and wiring.
 - d. Component (emergency station, master station, dome light, etc.) installation and operation
 - e. System programming
 - f. System trouble analysis

- g. Review of system documentation including O&M Manual content.
- h. Materials shall be provided for the number of students indicated.
- i. User Agency may video-record session(s) for use as future refresher materials for User Agency staff.

END OF SECTION 27 51 13

END OF DIVISION 27 – COMMUNICATIONS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 28 05 13 – VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. The work of this section includes the complete installation of a CCTV surveillance system, with multiple cameras, monitor, switching controls, digital recorder and necessary software, controllers, etc. All system equipment and commissioning shall be provided by the Electrical Contractor and the contractor shall provide the physical installation of all equipment, cabling required for this system. Provide any and all necessary rough-ins, conduits, pathways, fasteners, etc. for the installation of this system.

B. Install CCTV system in a wall-mounted equipment rack to be shared with the Public Address system. Please refer to Public Address System Specification Section 27-51-13.

1.02 DESCRIPTION OF WORK

A. Furnish all labor, materials for a complete installed system, as shown on the Drawings and herein specified.

B. Perform all required operations and coordinate with other crafts.

C. Obtain and pay for all permits and fees.

1.03 COORDINATION

A. Coordinate with all Trades to ensure cameras are installed in the optimum location for best coverage and clarity.

1.04 QUALITY ASSURANCE

A. CCTV system shall be installed by a Contractor normally engaged in the installation of these systems.

B. In the acceptance or rejection of work performed under this Section, no allowance will be made for lack of skill on the part of the workman.

C. All equipment and work shall conform to the requirements of the local building Codes and all legal authorities having jurisdiction.

D. Contractor shall be licensed for such work in the State of Wisconsin.

E. Contractor shall have successfully completed a minimum of (3) similar projects in Wisconsin.

1.05 CONTRACT DRAWINGS

A. The CCTV components are shown on the Drawings in schematic format only. Not all components are specifically shown. The Contractor is responsible for all design and layout.

B. It is the Contractor's responsibility to facilitate installation of the system, avoid interference's, coordinate with other trades and comply with the installation requirements of the manufacturer.

1.06 RECORD DOCUMENTS

A. During progress of the work, keep an up-to-date set of prints showing all changes made in the system from the original shop drawings and materials shown on the approved submittals. After completion of work provide the engineer with a set of as build shop drawings.

1.07 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the work and materials of this section before, during and after installation and to protect the work and materials of all other trades.

1.08 GUARANTEE

A. All labor and materials for one year after Substantial Completion certificate is prepared. All defective work shall be replaced to the full satisfaction of the engineer, and at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The manufacturer shall warrant the camera to be free from defects in material and workmanship according to i3 International warranty guidelines. All systems and components shall have been thoroughly tested, proven in actual use. All manufactured products shall include, at no additional cost: online support.

1. i3 International
2. Bosch

2.03 CONTROLLER/ DVR/ NVR RECORDER

A. This product shall be manufactured by a firm whose quality system is in compliance with the ISO 9001 standard. SRX-Pro Hybrid is RoHS Compliant. The manufacturer will provide a 3-year warranty on parts and 1-year on labour, excluding CMOS battery. The manufacturer will provide five (5) years of services and support from the manufacture date.

1. i3 International
2. Bosch

B. DIGITAL VIDEO STORAGE SPECIFICATION

1. The SRX-Pro 9i0000 shall be designed for high speed; high capacity digital video storage and high performance play back applications. The storage array will have a maximum of 9 hard drives including OS.
2. The SRX-Pro 9i0000 shall combine the leading edge video analytics technology with long-distance IP-networking technologies, reliability and outstanding performance.
3. The basic digital video non-RAID storage array, will have one 1TB hard drive with the following setup:
 - a. Drive C: 10GB/20GB
 - b. Drive D: 25GB
 - c. Drive E: approximately 448GB
 - e. Drive F: approximately 448GB
4. The non-RAID storage array is designed in such a way that additional disk drives can easily be added in single 1TB disk drive increments up to a maximum of 9 drives per unit.
5. The system supports either JBOD or RAID5 storage array. JBOD has no redundancy or data protection. RAID5 provides redundancy and data protection even if one hard disk drive completely fails. The RAID5 storage array comes with either 4 or 8 x 1TB hard disk drives. Each disk drive in the storage array is swappable, so that a failed drive can be easily replaced.
6. The Digital Video Storage Array will have LEDs located on all active devices to indicate the integrity of a given component or a given link.
7. The SRX-Pro 9i0000 shall support IP inputs only. The number of IP channels shall be upgradeable to 64.

C. ELECTRICAL/VIDEO SPECIFICATIONS

1. Input Voltage 115-230 VAC, 50-60 Hz, 600W auto ranging
2. Power Consumption Maximum 180 W
3. Signal System NTSC/PAL
4. Operating System Windows 7 Embedded
5. Recording Resolutions NTSCPAL
 - a. 320×240
 - b. 720×240
 - c. 720×480
 - d. 320×288
 - e. 720×288
 - f. 720×576
 - g. $1280 \times 1024(1.3M)$
 - h. $1600 \times 1200(2M)$
 - i. $1920 \times 1200(2.2M)$
 - j. $2040 \times 1530(3.0M)$
 - k. $2560 \times 920(5.0M)$
6. IP cameras supported Annexus: admin/1234 ACTi, Arecont, AXIS, Basler, Brickcom, Canon, CNB, FINE, FlexWATCH, Ganz, Grandeye, Infinova, IQinVision, JVC, Micropower, Mobotix, Panasonic, Pelco, PiXORD, Samsung, Sony, Stardot, Toshiba, Vivotek For the list of specific supported models and other information, please see GiPi Master Integration List.pdf
7. Recording Modes Human recognition (video analytics), continuous, motion detection, alarm activation, or scheduled recording
8. Internal Storage Supports 1-9 Hard drives up to a maximum capacity of 9TB (hardware upgrade required if more than 4TB)
9. Compression MJPEG, MPEG4, or MPEG4-H.264
10. Video Inputs IP (0 standard , upgradeable up to 64)
11. Hardware Watchdog System A hardware device to monitor for improper shutdown of the SRX-Pro Server; upon lockup or improper shutdown of the SRX-Pro Server, the recorder shall automatically reboot without losing any of the programmed settings.
12. Password Protection Multiple levels of protection for setup functions, operation, and system exiting. Each user shall have user-assignable features.

13. Motion Detection Detected Motion shall start the unit recording or if already recording, can increase the recording frame rate.
14. Motion Areas Selectable detection area and sensitivity for each camera.
15. Languages English, French, and Spanish
16. Alarm Activation Alarm input shall start the unit recording or if already recording, can increase the recording frame rate.
17. Motion Activation Detected Motion will start the unit recording or if already recording, can increase the recording frame rate.
18. Pre-Post Alarm/Motion Recording Shall record video for up to 10 seconds before the alarm sensor is activated/motion detected and/or up to 30 minutes after alarm sensor is activated/motion has stopped (optional).
19. Bandwidth Throttling Network throttling of transmitted video from 64 KB to unlimited
20. Alarm History Log Available through a query
21. Alarm Input Terminals 2 (user programmable, Normal Open/Normal Close)
22. Relay Output Terminals 2 user programmable dry contact
23. Relay Contact Ratings Rated (Resistive) Load 0.5 A
24. VGA Outputs 1 x Dedicated VGA (DB15) (main monitor)
25. Analog Video Outputs 0
26. Remote Control: Full remote control operation of pan, tilt, and zoom (PTZ) functions through TCP/IP network with PC or Web client.
27. LAN/WAN Connection Software shall be provided for viewing and controlling DVR over the network, including an exclusive remote-to-server connection feature. Viewing remotely shall be done with Internet Explorer 6.0 or higher, i3 Remote Agent, Blackberry devices (select models), and Android devices.
28. Color Palettes Minimum of 16 million color palettes
29. Gray Scale 256 shades

30. Backup management system shall be provided to back up data to external devices that are mapped to the server (CD, NAS or other storage devices) without interrupting hard disk recording.
31. Hard Disk Drives: 8 bay storage capability with hardware upgrade
32. Programming: On-screen programming and operation through a keyboard or mouse.
33. Digital Zoom: Digital zoom of the image on the screen during live and playback modes.
34. Authentication: Software shall be provided for image verification of each image recorded.
35. Help system: A built-in help system containing the information manuals needed for faster user reference shall be provided at both the server and remote client.
36. View Favorites: A mechanism to bookmark video events, name them, and retrieve by name shall be provided.
37. Instant Playback Feature: The option of searching single or multiple cameras on Live screen at different times within the current calendar day (24 hour time period) shall be provided.
38. Video Loss Detection: Video loss events shall be linked to alarms that shall trigger a relay and send an email notification.
39. ATM/POS Communication: Shall provide data interface support for ATM/POS/Card Access devices. Up to 8 serial/16 (TCP/IP) ports per server
40. Software Upgrades: Upgrades shall be provided during warranty period at no charge.
41. System Health Check: Operating parameter thresholds for CPU and hard drive components shall be monitored, an alert message shall be generated working in conjunction with Central Management Software (CMS) when those thresholds are exceeded.
42. VideoLogix™ Shall provide four (4) channels of video analytics to monitor human and object activities. The number of video analytics channels shall be upgradable to 16.

D. MECHANICAL SPECIFICATIONS

1. Connectors
 - a. USB keyboard/Mouse (2 back)
 - b. USB 6 x USB 2.0 ports (2 front, 4 back)
 - c. DB15 VGA Port
 - d. RJ45 2 x 10/100/1000 Gigabit Ethernet port
 - e. RS485 1 × RS485 ports for PTZ control
2. Standard Audio Connectors
 - a. Audio Levels
 - b. Miniature phone jack 2 × 2-channel (right/left) miniature phone jacks for line in and microphone in miniature phone jack for audio output.

E. PHYSICAL SPECIFICATIONS

1. Rack Mount Aluminum (LxWxH) 22³/₄" x 17" x 7¹/₂" (577.9 mm x 431.8 mm x 190.5 mm)
2. Operating Temperature 20° - 25°C or 68° - 77°F
3. Relative Humidity < 90%, non-condensing
4. Optical Drive DVD/CD-RW

F. REMOTE CLIENT REQUIREMENTS

1. Recommended PC Requirements:
2. CPU - Intel 2.4GHz Core2DUO or higher
3. RAM - 1GB minimum
4. Video card - ATI Radeon 64MB AGP or higher
5. OS - Windows XP/7
6. VGA Resolution - 1024x768 screen resolution with 32 bit color minimum
7. Hard Drive Space - 1.5 GB Free Hard Drive space minimum
8. Connectivity - High speed Internet with greater than 512 Kb/s
9. Pre-requisites (optional) MS Windows .NET Framework v3.0, MS Visual C++ 2005 SP1 Redistributable Package (x86), Nero 6.6.1.15 or Nero 8 or better

G. CERTIFICATIONS

1. ULc/TUV

H. MODEL NUMBERS

1. 9i0000 (non-RAID)
2. 8i0000 (RAID5)

I. UPGRADE OPTIONS

1. 1-TB-UG - Upgrade 1 Additional 1TB Hard Drive (Total 2TB)
2. 1-2TB-UG - Upgrade 1 Additional 2TB Hard Drives (Total 3TB)
3. 4-1TBB-UG - Upgrade 4 Additional 1TB Hard Drives (Total 5TB)
1. 4-2TBB-UG - Upgrade 4 Additional 2TB Hard Drives, 1 x 80GB OS drive, 1 SATA Expansion Card, RAID5 configuration (Total 3 TB)

2.04 POE ENABLED NETWORK SWITCHES

A. SUMMARY

1. The Layer 2, Ethernet switches are a series of managed, entry level, edge switches that are used as access devices to provide entry points into core networks. The switch enables connectivity for up to eight, 10/100 twisted pair copper ports which are automatically configured to provide ease and speed of installation. The SW-24400 shall have 2-Ports (two mini-GBIC slots) 1000Base-SX/LX/BX (Shared).

B. REFERENCES

1. Federal Communications Commission (FCC) Part 15 Class A
2. Underwriters Laboratories Inc (UL)

C. SYSTEM DESCRIPTION

1. Performance Requirements
2. Provide edge connectivity into core networks.
3. Provide eight or 24, 10/100Mbps RJ45 ports.
4. Provide two, 1000Base-SX/LX/BX (Shared)
5. Provide ports with a self-adaptive function.
6. Possess a power consumption of 260 Watts/58.6 BTU.
7. Operate in temperature ranges of -0 ~ 50 Degree C.
8. Possess port status indicators.
9. Possess a dual redundant, broad power input.

D. PROJECT/SITE CONDITIONS

1. Temperature Requirements: Layer 2, Industrial Ethernet switch products shall operate in an environment with a temperature range of: 0 ~ 50 Degree C.
2. Humidity Requirements: Products shall operate in an environment with relative humidity of 20% to 95% (non-condensing).

E. SYSTEM PERFORMANCE

1. The Layer 2 Ethernet switch products shall include, as a minimum, the following features/functions/specifications:
2. The system shall provide edge connectivity into core networks.
3. The system shall provide eight 10/100Mbps RJ45 ports, two SFP/mini-GBIC Slots (2 10/100/1000Base-T RJ-45 Auto-MDI/MDI-X ports).
4. The system shall provide port status indicators and dual redundant, broad range power inputs.
5. The system shall use Store & Forward as its switching method.
6. The system's throughput rate shall be 2.75Mpps @64Bytes and shall have an 4K MAC address table with auto learning function.
7. The module shall have a power consumption figure of 260 Watts / 58.6 BTU.
8. The system shall have an operating temperature of 0 ~ 50 Degree Celsius and have an operating humidity of 20 to 95% non-condensing.
9. The system radiated emission shall be compliant with FCC Part 15/EN55022, Class A.

F. SIGNAL SPECIFICATIONS

1. PoE Management shall include the following:
 - a. Per port PoE function enable/disable
 - b. PoE Admin-mode control
 - c. PoE Port Power feeding priority
 - d. Per PoE port power limit
 - e. Over Temperature Protection function
 - f. Temperature Threshold Control
 - g. PoE Usage Threshold Control

2. Ethernet Interface Specifications shall include the following standard of compliance:

- a. IEEE 802.3 10Base-T
- b. IEEE 802.3u 100Base-TX
- c. IEEE 802.3ab 1000Base-T
- d. IEEE 802.3z 1000Base-SX/LX
- e. IEEE 802.3x Flow Control and Back pressure
- f. IEEE 802.3ad Port trunk with LACP
- g. IEEE 802.1D Spanning tree protocol
- h. IEEE 802.1s Multiple spanning tree protocol
- i. IEEE 802.1p Class of service
- j. IEEE 802.1Q VLAN Tagging
- k. IEEE 802.1x Port Authentication Network Control
- l. IEEE 802.3af Power over Ethernet
- m. RFC 768 UDP
- n. RFC 793 TFTP
- o. RFC 791 IP
- p. RFC 792 ICMP
- q. RFC 2068 HTTP
- r. RFC 1112 IGMP version 1
- s. RFC 2236 IGMP version 2
- t. RFC 2236
- u. Interface: RJ45 Auto-MDI/MDI-X.
- v. Data Rate: 10/100 Mbps (Manual or auto-negotiate).
- w. Operating Mode: Half or full-duplex

3. Switch Specifications

- a. Switching Method: Store & Forward
- b. Switch throughput: 2.75Mpps @64Bytes
- c. Backplane Switch Capacity: 5.6Gbps
- d. Mac Address Table: 4k

4. Status Indicators

- a. Power (Green)
- b. Link / Activity (Green)
- c. PoE In-Use (Orange)
- d. 1000 LNK / ACT(Green)
- e. 10/100 LNK / ACT(Orange)

G. POWER SPECIFICATIONS

- 1. Power Input: 100 ~ 240V AC, 50/60Hz
- 2. Power Consumption: 260 Watts / 58.6 BTU
- 3. Power over Ethernet
- 4. PoE Standard: IEEE 802.3af Power over Ethernet / PSE
- 5. PoE Power Supply Type: End-Span

6. PoE Power Output: Per Port 48V DC, 350mA . Max. 30 Watts
7. Power Pin Assignment: 1/2(+), 3/6(-)
8. PoE Power Budget: 260 Watts*
9. Max. number of Class 2 PD: 8
10. Max. number of Class 3 PD: 8

H. MECHANICAL SPECIFICATIONS

1. Dimensions (W x D x H): 266 x 160 x 44mm
2. Weight: 2.5kg
3. Reset Button: < 1-5 seconds/ System reboot >10 seconds: Factory Default

I. ENVIRONMENTAL SPECIFICATIONS

1. Operating Temperature: -40°C to +74°
2. Storage Temperature: -40°C to +74°C
3. Humidity: 5% to 95% (non-condensing)
4. Emissions: FCC CFR47 Part 15/EN55022, Class A
5. Mean Time between Failure: >300,000 hours

J. EXAMINATION

1. Inspect modules before installation to verify physical condition as well as inclusion of all peripheral materials
2. Modules shall be free of any cosmetic defects or damage.
3. Shipping box shall include the module, power supply cable and operations manual (CD format).

K. PREPARATION

1. Rack mount shall be mounted on a properly prepared surface adequate for the size and weight of module. The placement of the unit shall allow provision for cable installation and maintenance as indicated on the approved detail drawings and according to the installation manual.

L. INSTALLATION

1. General: The Layer 2, Ethernet switch products must be installed, configured, and tested according to the manufacturer's instructions.

M. MANUFACTURER

1. i3 INTERNATIONAL, MODEL SW-24400.

2.05 INDOOR CAMERAS

A. MANUFACTURER: i3 Model #AX52D Indoor Network Dome

B. GENERAL CAMERA DESCRIPTIONS

1. The network camera shall be fully iP-Pro or SRX-Pro series compatible and shall provide a Web client interface that can be used to view live and recorded video, review and control relays and alarms, review and acknowledge events, configure the gateway, and configure gateway users.

2. The network camera shall provide recording up to the following frame rates and resolutions NTSC: 1920 X 1080 @15fps and 1280 X 720 @30fps OR PAL: 1920 X 1080 @12.5fps and 1280 X 720 @25fps.

3. The network camera shall communicate with the Microsoft®Internet Explorer®6.0 Video from the Annexus IP camera shall be compatible with Microsoft Windows®systems.

4. The network camera specified shall be an industrial grade, color, full-featured, high-speed 2.0 megapixel network camera. The product is designed to meet or exceed industrial and surveillance applications requiring a low power, rugged video camera with IP network capability. It is IEEE 802.3af Power-over-Ethernet ready and can also be powered directly using 24 VAC. The camera shall include a NTSC/PAL analog public view output.

5. The network camera shall meet or exceed the following design and performance specifications.

C. GENERAL CAMERA REQUIREMENTS

1. The high-resolution color camera specified shall incorporate a 1/3" 2 Megapixel image sensor and a mechanical ICR varifocal lens.

2. Minimum light requirement to produce an image shall be approximately 0.08 Lux @ 10 IRE

3. The camera shall provide an Auto Electronic Shutter (AES), 255 levels of sensitivity for sharpness, saturation, brightness and contrast, and 5 levels of WDR sensitivity.

D. CAMERA NETWORKING REQUIREMENTS

1. The camera shall provide integrated support for TCP/IP, UDP, HTTP, FTP, DNS, DHCP, NTP, RTP, RTSP, ICMP, uPNP.

2. The camera shall be capable of displaying streaming of an image simultaneously. Video stream shall be selectable as main stream or sub stream.

3. No unique or proprietary client software shall be required for viewing or controlling the camera.

E. CAMERA RECORDING/PLAYBACK REQUIREMENTS

1. The manufacturer shall offer optional, licensable recording and playback software that allows images to be recorded to an external server.

2. Images may be stored at a fixed periodic record rate and/or when triggered by motion and/or external input. Playback shall allow all images recorded to be viewed forward or backward in time with the licensable recording and playback software.

3. The camera shall record images as H.264, MPEG4 or Motion JPEG.

F. GENERAL CAMERA SPECIFICATIONS

1. Image system

- a. Image sensor - 1/3" image sensor
- b. Effective pixels - 1920 (H) X 1080 (V)
- c. Image Compression Method - H.264/MPEG4/Motion JPEG
- d. Image frame rate up to 1920 X 1080 @15fps, 1280 X 720 @30fps
- e. Video port - BNC X1, 1.0Vp-p, 75Ω / RCA x 1
- f. Audio in & out port - 3.5mm Phone Jack x 2
- g. Alarm Ports - 2 in / 1 out

2. Electric System

- a. Sync system - Internal
- b. Built in lens - f=3~9mm, F1.2 Megapixel
- c. Electronic shutter - NTSC: 1/10000s to 1/3.75s PAL: 1/10000s to 1/3.125, selectable
- d. SD card slot - Micro SD/SDHC up to 32 GB

3. Networking

- a. Ethernet - 1 x 10/100 base-T Ethernet connection for LAN/WAN
- b. Network port - RJ45
- c. Protocols - TCP/IP, UDP, HTTP, FTP, DNS, DHCP, NTP, RTP, RTSP, ICMP, uPNP.

G. POWER SPECIFICATIONS

1. Power requirement - DC 12V & AC 24V $\pm$ 10% / POE
2. Power connector - Screwless terminal block
3. Power consumption - Max 5W

H. ENVIRONMENTAL SPECIFICATIONS

1. Operating temperature -10°C ~ 50°C (14°F ~ 122°F)
2. Operating humidity 10~ 90% RH
3. Storage temperature -20°C ~ 60°C (-4°F ~ 140°F)

I. PHYSICAL SPECIFICATIONS

1. Dimensions (øxH) ø138mm × 102mm (ø5.43" ×4.01")
2. Weight 816g (1.8lb)
3. Protection Class - Vandal Resistant

J. CERTIFICATIONS

1. FCC, CE, RoHS

2.06 OUTDOOR CAMERAS

A. MANUFACTURER: i3, model #AX52V Outdoor Network Dome

B. GENERAL CAMERA DESCRIPTIONS

1. The network camera shall be fully iP-Pro or SRX-Pro series compatible and shall provide a Web client interface that can be used to view live and recorded video, review and control relays and alarms, review and acknowledge events, configure the gateway, and configure gateway users.
2. The network camera shall provide recording up to the following frame rates and resolutions NTSC: 1920 X 1080 @15fps and 1280 X 720 @30fps OR PAL: 1920 X 1080 @12.5fps and 1280 X 720 @25fps.
3. The network camera shall communicate with the Microsoft®Internet Explorer®6.0 Video from the Annexus IP camera shall be compatible with Microsoft Windows®systems.

4. The network camera specified shall be an industrial grade, color, full-featured, high-speed 2.0 megapixel network camera. The product is designed to meet or exceed industrial and surveillance applications requiring a low power, environment resistant, rugged video camera with IP network capability. It is IEEE 802.3af Power-over-Ethernet ready and can also be powered directly using 24 VAC. The camera shall include a NTSC/PAL analog public view output.

5. The network camera shall meet or exceed the following design and performance specifications.

C. GENERAL CAMERA REQUIREMENTS

1. The high-resolution color camera specified shall incorporate a 1/3" 2 Megapixel image sensor and a mechanical ICR varifocal lens.

2. Minimum light requirement to produce an image shall be approximately 0.08 Lux @ 10 IRE

3. The camera shall provide an Auto Electronic Shutter (AES), 255 levels of sensitivity for sharpness, saturation, brightness and contrast, and 5 levels of WDR sensitivity.

D. CAMERA NETWORKING REQUIREMENTS

1. The camera shall provide integrated support for TCP/IP, UDP, HTTP, FTP, DNS, DHCP, NTP, RTP, RTSP, ICMP, uPNP.

2. The camera shall be capable of displaying streaming of an image simultaneously. Video stream shall be selectable as main stream or sub stream.

3. No unique or proprietary client software shall be required for viewing or controlling the camera.

E. CAMERA RECORDING/PLAYBACK REQUIREMENTS

1. The manufacturer shall offer optional, licensable recording and playback software that allows images to be recorded to an external server.

2. Images may be stored at a fixed periodic record rate and/or when triggered by motion and/or external input. Playback shall allow all images recorded to be viewed forward or backward in time with the licensable recording and playback software.

3. The camera shall record images as H.264, MPEG4 or Motion JPEG.

F. GENERAL CAMERA SPECIFICATIONS

1. Image system
 - a. Image sensor 1/3" image sensor
 - b. Effective pixels 1920 (H) X 1080 (V)
 - c. Image Compression Method H.264/MPEG4/Motion JPEG
 - d. Image frame rate up to 1920 X 1080 @15fps, 1280 X 720 @30fps
 - e. Video port - BNC X1, 1.0Vp-p, 75Ω / RCA x 1
 - f. Audio in & out port - 3.5mm Phone Jack x 2
 - g. Alarm Ports - 2 in / 1 out
2. Electric System
 - a. Sync system - Internal
 - b. Built in lens - f=3~9mm, F1.2 Megapixel
 - c. Electronic shutter - NTSC: 1/10000s to 1/3.75s PAL: 1/10000s to 1/3.125, selectable
 - d. SD card slot - Micro SD/SDHC up to 32 GB
3. Networking
 - a. Ethernet - 1 x 10/100 base-T Ethernet connection for LAN/WAN
 - b. Network port - RJ45
 - c. Protocols- TCP/IP, UDP, HTTP, FTP, DNS, DHCP, NTP, RTP, RTSP, ICMP, uPNP.

G. POWER SPECIFICATIONS

1. Power requirement - DC 12V & AC 24V $\pm$ 10% / POE
2. Power connector - Screwless terminal block
3. Power consumption - Max 5W without heater

H. ENVIRONMENTAL SPECIFICATIONS

1. Operating temperature -40°C ~ 50°C (-40°F~122°F)
2. Operating humidity 10~ 90% RH
3. Storage temperature -20°C ~ 60°C (-4°F ~ 140°F)

I. PHYSICAL SPECIFICATIONS

1. Dimensions (øxH) ø142mm × 120.8mm (ø5.59" × 4.75")
2. Weight 1247g (2.75lb)
3. Protection Class - Vandal Resistant, IP67, impact resistance of 1000 kg

J. CERTIFICATIONS

1. FCC, CE, RoHS

2.07 WIRE AND CABLE

- A. Category 6 communication cable as recommended by manufacturer. Installer to coordinate with the supplier to understand all cabling requirements.
- B. The owner shall not be charged for any cabling that was not understood as part of the sealed bid.
- C. Provide signal extenders and/or boosters as required for lengths greater than 295 feet.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify surfaces and areas are ready to receive work.
- B. Verify field measurements are accurate and shown on drawings.
- C. Verify proper power connections are installed.
- D. Proceed with installation only after unsatisfactory conditions are corrected.
- E. All wiring shall test free from grounds and shorts.

3.02 INSTALLATION

A. General:

- 1. The complete installation shall be done in a neat, workmanlike manner according to all applicable codes and the manufacturer's recommendations.
- 2. Install all fixtures, materials, assemblies and equipment in strict accordance with manufacturer's recommendations and instructions. Consult manufacturer/equipment supplier for all wiring diagrams, schematics, sizes, outlets, etc. before installing.
- 3. Install power supplies as required based on equipment per manufacture
- 4. Mount all equipment except portable equipment firmly in place. Clearly, logically and permanently mark all switches, jacks and receptacles.

B. Cable Installation:

- 1. Install all equipment per manufacturer's instructions and directions.

2. In areas where cable trays are not used for cable properly support cable throughout. Cables shall not be installed in a hap-hazard manner across the ceiling grid system.

3. In those areas where there is not an existing ceiling, all system cables shall be routed through conduit, through the non-ceiling area, into an area where there is ceiling cavity. There shall be no open cables routed through ceiling areas, unless it is indicated otherwise on the drawings.

C. Cleaning:

1. Prior to turning the system over to the Owner, the system shall be physically cleaned.

2. All appearance defects shall be carefully and professionally touched up so that the equipment is in "factory new" condition.

3. At the completion of the work, remove from the building and the premises all rubbish and debris resulting from the work.

D. Cable:

1. Cable type, size, and quantity to be as shown on drawings. Vendor to verify exact cable required based on the equipment and provide appropriate cable.

2. All cables to be non-plenum rated.

3. All wire runs shall be continuous lengths, without splices.

4. Marker strips shall be attached to the field wiring. These markers shall not change when devices are replaced during repair or maintenance.

5. Within equipment cabinets, all wires and cables shall be contained in wire management channels and dressed and labeled in such a manner that all wires may be easily traced, and such that they do not obstruct access to components which may need to be replaced or serviced.

E. On Site Programming:

1. The Equipment Provider shall provide on-site programming. The Equipment Provider shall program the unit in conjunction with the owner's requirements.

F. Final Testing:

1. All wiring shall test free from all grounds and shorts.
2. Upon completion of the installation, the system must be tested by the Electrical Contractor.
3. Upon completion of the testing, the Electrical Contractor shall issue to the Owner a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed and free of defects, and that the system is in compliance with this specification.

END SECTION 28 05 13

SECTION 28 13 00 – AIPHONE DOOR ENTRY INTERCOM SYSTEM

PART 1 – GENERAL

1.01 SCOPE

- A. Hands-free color audio video system with pan, tilt, and zoom.

1.02 SYSTEM DESCRIPTION – HANDS-FREE COLOR VIDEO INTERCOM MASTER MONITOR STATION

- A. Answering Door Call in Hands-Free Mode:

1. Press CALL button.
2. Chime tone sounds, caller is seen on video monitor, and outside sound is heard.
3. Audio and video turn off after approximately 45 seconds if not answered.
4. Press TALK button momentarily, and after beep, communicate hands free. Red transmit LED lights when you talk, and goes off as you listen to caller or hear outside sounds.
5. After finishing communication, press OFF button and communication will end after beep.

- B. Answering Door Call in Press-to-Talk (PTT) Mode:

1. Press CALL button.
2. Chime tone sounds, caller is seen on video monitor, and outside sound is heard.
3. Audio and video turn off after approximately 45 seconds if not answered.
4. Press and hold TALK button for minimum of 1 second. Beep sounds, and after approximately 1 second another beep sounds, which indicates PTT mode is engaged. If TALK button is pressed less than 0.5 seconds, PTT mode is not engaged.
5. When communicating, keep TALK button pressed. To hear caller's voice, release TALK button.
6. After finishing communication, press OFF button and communication will end after beep.

C. Activating Door Release:

1. Press DOOR RELEASE button.
2. Open door while release mechanism is activated. During release, red DOOR RELEASE LED flashes.

D. Entrance Monitoring:

1. Press MONITOR button in standby mode.
2. Video monitor displays image from door station and incoming audio is heard. If you do not press TALK button, caller will not hear sounds from inside station.
3. Press OFF button to end communication.

E. Night Illumination:

1. At night, door station illuminator LED lights up during calling or communication.
2. When Call is made from Door Station:
 - a. If CALL button of door station is pressed, illuminator LED lights up.
 - b. When communication ends, illuminator LED will go out.
3. Light Up Illuminator LED During Entrance Monitoring:
 - a. When TALK button is pressed during entrance monitoring, communications starts and illuminator LED will light up.
 - b. Inside sound can be heard at entrance.
 - c. When communication ends, illuminator LED will go out.

F. Backlight Adjustment, Night Sensitivity Adjustment:

1. To perform adjustment, press ADJUST button when image is difficult to see. Automatic adjustment to more visible screen is performed.
2. To cancel adjustment, press ADJUST button during adjustment.

1.03 SUBMITTALS

- A. Comply with Section 01 3300 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Shop Drawings: Submit the following:

1. Wiring Diagrams: Indicate wiring for each item of equipment and interconnections between items of equipment.

2. Include manufacturer's names, model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

D. Installation and Operation Manuals:

1. Submit manufacturer's installation and operation manual, including operation instructions and component wiring diagrams.

2. Provide detailed information required for Owner to properly operate equipment.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: ISO 9001:2008 certified company.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors according to manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

1.06 WARRANTY

A. Warranty Period: One year from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Aiphone Corporation, 1700 130th Avenue NE, Bellevue, Washington 98005. Toll Free (800) 692-0200. Phone (425) 455-0510. Fax (425) 455-0071. Website www.aiphone.com. E-mail info@aiphone.com.

2.02 VIDEO INTERCOM AND ACCESS CONTROL SYSTEM

A. Hands-Free Color Video Intercom Master Monitor Station: Model JK-1MED.

1. Power: 18 V DC.
2. Current Consumption: 400 mA maximum.
3. Calling: Chime and image, approximately 45 seconds.
4. Communication:
 - a. Hands-Free Mode: Hands free 60 seconds.
 - b. PTT Mode: Press-to-talk, release-to-listen 60 seconds.
5. Video Monitor:
 - a. 3.5-inch direct-view TFT color LCD.
 - b. Scanning Lines: 525.
6. Door Release Contact: 24 V AC/DC, 500 mA (N/O dry closure contact L, L).
 - a. Minimum Contact: 100 mV DC, 0.1 mA.
7. Operating Temperature: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).
8. Microphone.
9. Red door release LED.
10. DOOR RELEASE button.
11. Red menu LED.
12. MENU button.
13. PAN/TILT button.
14. ZOOM/WIDE button.
15. ADJUST button.
16. CALL button.
17. Option button.
18. Red transmit LED.

19. TALK button.
20. OFF button.
21. MONITOR button.
22. Red play LED.
23. PLAY button.
24. Red record LED.
25. RECORD button.
26. POWER switch.
27. Speaker.
28. Screen brightness control.
29. Receive volume control.
30. Chime tone volume.

B. Vandal-Resistant Video Door Station: Model JK-DV.

1. Faceplate: Die-cast zinc.
2. Surface mount.
3. Microphone.
4. Speaker.
5. Camera:
 - a. Complementary metal oxide semiconductor (CMOS).
 - b. Scanning Lines: 525.
 - c. Minimum Subject Illumination: 5 Lux at 50-cm (1'-6") distance.
6. CALL button.
7. Vandal resistant.
8. Weather resistant.

9. Operating Temperature: 14 degrees F to 140 degrees F (minus 10 degrees C to 60 degrees C).

2.03 ACCESSORIES

- A. Form C Door Release Relay: Model RY-18L.

1. For 1 door.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive hands-free color video system with pan, tilt, and zoom.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

- A. Install hands-free color video system with pan, tilt, and zoom according to manufacturer's instructions at locations indicated on the Drawings.
- B. Mount equipment plumb, level, square, and secure.

3.03 ADJUSTING

- A. Adjust hands-free color video system with pan, tilt, and zoom for proper operation according to manufacturer's instructions.

3.04 DEMONSTRATION AND TRAINING

- A. Demonstration:
 1. Demonstrate that hands-free color video system with pan, tilt, and zoom functions properly.
 2. Perform demonstration at final system inspection by qualified representative of manufacturer.
- B. Instruction and Training:
 1. Provide instruction and training of Owner's personnel as required for operation of hands-free color video system with pan, tilt, and zoom.

2. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.
3. Provide instruction and training by qualified representative of manufacturer.

3.05 PROTECTION

- A. Protect installed hands-free color video system with pan, tilt, and zoom from damage during construction.

END OF SECTION 28 1300

45. Well Pump and Controls, Item SPV.0105.105.

A Description

This special provision describes the furnishing and installation of a well pump and controls as shown in the plans and hereinafter provided.

A.1 Scope

The design intention is to install a well pump and water line piping capable of supplying potable water at a rate of at least 55 gallons per minute (gpm) at a total dynamic head (TDH) of 95 feet. The TDH is based on the estimated static and dynamic (pumping) water levels plus the head loss due to pipe friction at 60 gpm. The friction head loss at 60 gpm shall be as follows: 2 inch diameter, for Type K copper pipe 4.1 feet per 100 feet, for Galvanized steel pipe 5.2 feet per 100 feet. Therefore, final pump selection will be made by the engineer after the well test pumping has been completed.

B Materials

B.1 Pump

The submersible well pump shall comply with the latest revision of NR 812 of the Wisconsin Administrative Code.

The well pump shall be capable of running continuously without damage to the motor. Pump water passages shall be designed to handle sandy water without significant abrasion. The pump shall feature stainless steel bowls stacked and rabbet locked together on a hex shaft. The pump casing shall be stainless steel. The pump shall be supplied with a standard control box.

The well pump shall be at least a 5-HP, single-phase, 230 volt unit, with hermetically sealed stator, as manufactured by: Goulds Pump, Inc., Grunfos Pump Corp., Franklin Pump Systems or an approved equal. The well pump shall be set at the level shown in the well profile detail on the plans.

The well pump, motor control box shall be furnished by the well pump manufacturer.

B.2 Well Related Products and Materials

B.2.1 Pressure Switch

Furnish and install a pressure switch capable of setting an acceptance pressure of 45 to 65 psi and for use with a single-phase, 240 volt, 7 1/2 HP pump motor. Switches manufactured by Square D or Furnas are acceptable.

B.3 Water Service Piping

The water service piping from the well to the building shall meet the requirements of COMM 82.40 and COMM 84, of the Wisconsin Administrative Code.

The water line from the well to the building shall be Type K copper water tube, ASTM B88. Fittings and connectors shall be cast or wrought copper pressure fittings. Solder type fittings shall be connected with lead free (<0.2%) solder.

C (Vacant)

D Measurement

The department will measure Well Pump and Controls as a single lump sum unit of work, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.105	Well Pump and Controls	LS

Payment is full compensation for furnishing, installing, transportation, and incidentals necessary to complete the work as specified herein.

46. Emergency Generator, Item SPV.0105.106.

A Description

Scope

The work under this section includes providing and installing a complete factory assembled packaged engine generator system with controls and startup testing. The generator is intended to provide electrical power for critical building operations and communications during power outages.

B Materials

Refer to article Section 26 32 00 - Packaged Generator Assemblies under SWEF Building, Electrical, SPV.0105.104 for materials information.

C Construction

Refer to article Section 26 32 00 - Packaged Generator Assemblies under SWEF Building, Electrical, SPV.0105.104 for construction and installation information.

D Measurement

The department will measure Emergency Generator as a single lump sum unit of work, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.106	Emergency Generator	LS

Payment is full compensation for Emergency Generator, measured as provided above will be paid for at the contract lump sum price, which price shall be full compensation for furnishing the generator and installing all equipment, all utility hook-ups, and for

furnishing all labor, supervision, equipment, calibrating and testing, warranties, training, tools and incidentals items for installing and supplying the Emergency Generator.

The LP gas tank will be paid for under a separate bid item. The transfer switch will be paid for under SWEF Building, Electrical.

47. Holding Tanks, Item SPV.0105.107.

A General

A.1 Related Documents

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

A.2 Summary

This section includes the following:

1. Holding tanks, controls, and accessories for a complete installation.

Related sections: The following sections contain requirements that relate to this section:

1. Division 31- Earthwork
2. Division 22 - Plumbing

A.3 Submittals

Product Data: For the following:

1. Holding tanks.
2. Pipe and fittings.

Shop Drawings: Include manhole openings, covers, pipe connections, and accessories for the following precast concrete surfaces:

1. Holding tanks.
2. Wiring diagram for power, signal, and control wiring.

A.4 Definitions

PVC – Polyvinyl Chloride Plastic.

"Service provider" means the individual or company that is responsible for managing and maintaining the holding tank.

B Products

B.1 Holding Tank

Tank Size:

1. Minimum liquid capacity of a holding tank 3000 gallons.
 - a. Available tank products: Low profile, 3000 gallon, single chamber tanks; Manufactured by Wieser Concrete 2815 Riley Road Portage, WI 53901, Phone (608) 742-4464; Lakeshore Buried Vault Company, Brookfield, WI; Jones Concrete Products Co., Madison, WI; Crest Products Inc., La Crescent, MN; or approved equal.

Requirements

1. Precast Concrete Holding Tanks: ASTM C 1227, single-chamber, precast, reinforced-concrete tank with internal baffle and covers.
 - a. Design: For A-16 (HS20-44) traffic loading according to ASTM C 890.
 - b. Manholes: 22-inch (559-mm-) minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. The manhole is to be located over pipe inlet.
 - c. Resilient Connectors: ASTM C 923, of size required for piping, fitted into inlet.

Monitoring/Management Equipment:

1. The alarm for the holding tank installation is an audible and visual alarm posted in a conspicuous location in the building served and on a post near the tank protected from the weather. The alarm is connected to a float in the holding tank.
 - a. Available alarm products:
 - 1) SJE Rhombus, Model 101.
 - 2) Septronics # 2001.
 - 3) Or approved equal.

Sanitary Piping:

1. 4-inch PVC, complying with specifications of COMM. 84, Table 84.30-3.

Permits:

1. The installing contractor shall be responsible for obtaining a Sanitary Permit from the department or governmental unit having jurisdiction.

Insulation:

1. Description: Rigid, cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or XIII.
 - a. Thickness: 2-1/2 inches (65 mm) minimum.
 - b. Recycled Content: Not less than 50 percent blend of postconsumer and recovered polystyrene resins.

C Execution

C.1 Site Preparation and Construction

C.1.1. Site Preparation

Provide a minimum of 3 inches of compacted bedding material under the holding tank. Bedding material shall be sand, gravel, crushed limestone. 100% of the bedding material passes a 1/2-inch screen.

C.1.2. Sanitary Permit

Prior to the construction of the system, the installing contractor shall obtain a sanitary permit for the installation. This permit must be posted in a clearly visible location on the site. The installing contractor shall also make arrangements for inspection(s) must also be made with the governmental unit issuing the sanitary permit.

C.1.3 Tank Installation

Take care in setting the tank to avoid damage to the structural integrity of the tank. The excavation for the tank shall provide at least 12 inches of space around the tank to allow free flow of backfill material along the tank walls. Clear interior of piping and structures of dirt and other superfluous material as work progresses.

Also,

1. The tank shall be set level.
2. Access openings that terminate at grade shall have water and gas tight access ports. Access openings that terminate at least 24 inches above the surrounding grade are not required to have water and gas tight access ports.
3. Provide connection of the holding tank to the sanitary sewer by means of a mechanical compression type joint conforming to s. Comm 84.40, Wis. Adm. Code.
4. Install all access ports so as to permit a minimum of 3 feet of clear space above the port and 2 feet in all directions horizontally from any point of the access port.
5. Below grade connections. Joints between the tank, access ports, access opening risers, and covers shall be watertight if located below finished grade.
6. Where a holding tank is installed in saturated soils (see Comm 85 for the determination of soil saturation), anchor the tank using the following equation:
 - a. $\text{Weight of anchor} = 1.5 \times \text{tank volume in cubic feet} \times 62.4 \text{ pounds per cubic foot} - \text{weight of tank}.$
7. Install insulation on exterior sides and top of holding tank.
8. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plugs in end of uncompleted pipe at end of workday or when work stops.
9. Tests: Fill tank with water and let stand overnight. If water level recedes, locate and repair leaks and retest. Repeat tests and repairs until no leaks exist.

C.1.4 Monitoring/Alarm Equipment Installation

C.1.4.1 Alarm Installation

Set the alarm float to turn on the alarm when liquid volume is at 12 inches below tank inlet invert or at 90% of the liquid capacity of the tank below the tank inlet invert. Install the alarm wiring in accordance to NEC 300 and ILHR 16.23, Wis. Adm. Code.

C.1.5 Backfill

Backfill the holding tank excavation with soil material and tamp into place. No stones greater than 3/4-inch will be permitted in the backfill material.

C.2 Operation and Maintenance and Performance Monitoring

User's Manual: A user's manual shall accompany the component. The manual is to contain the following as a minimum:

1. Diagrams of all components and their location.
2. Names and phone numbers of local health authority, component manufacturer or POWTS service provider to be contacted in the event of component failure or malfunction.

3. Information on the periodic maintenance of the component, including electrical/mechanical components.

C.3 Installation Inspection

The installing contractor shall be responsible to coordinate the site inspections during and after the construction. The state or other appropriate jurisdictions accordance with ch. Comm 83 of the Wis. Adm. Code shall accomplish such inspections.

Prior to owner acceptance, inspection shall be made in accordance to ch. 145.20, Wis. Stats., and s. Comm 83.26, Wis. Adm. Code, using the inspection form on the following two pages. The inspection of the component installation and/or plans is to verify that the component at least conforms to specifications listed in Tables 1 and 2 of this section. The completed forms shall be submitted as part of the user's manual. (Refer Forms on the Following Two Pages)

POWTS HOLDING TANK INSPECTION REPORT

(Attach To Permit)

GENERAL INFORMATION			
Permit Holder's Name	☐ City ☐ Village ☐ Town of	County	Sanitary Permit No.
State Plan ID No.	Tax Parcel No.	Property Address if Available	

TANK INFORMATION		
Type	Manufacturer	Capacity

SETBACKS						
Property Line	Well	Water Service	Building	Service Road	OHW	Swimming Pool

DEVIATIONS FROM APPROVED PLAN	
Date of Inst. Directive:	Date of Enforcement Order:
Date of Referral to Legal Counsel:	
COMMENTS (Persons present, discrepancies, etc.)	
COMPONENTS NOT INSPECTED	
Plan Revision	Required Signature of Inspector:

Sketch on other side

ELEVATION DATA					
Point	Back sight	Height of instrument	Foresight	Elevation	Comments
Bldg. sewer					
Tank inlet					
Tank outlet					
Tank inlet					
Tank outlet					

Sketch of Component and Additional Comments:

D Measurement

The department will measure Holding Tanks, completed in accordance 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.0105.107	Holding Tanks	LS

Payment is full compensation for furnishing and installing all materials and equipment, excavation, backfill, permits.

48. Lightning Protection and Grounding System, Item SPV.0105.108.**A Description**

This special provision describes furnishing and installing a ground grid system to provide a ground path for lightning protection and an equal potential ground plane for the entire site. Install all work in accordance to standard specs 651 through 660, as approved by the engineer, and as hereinafter provided.

B Materials

Ground rods shall be 10 foot long by 5/8 inch in diameter copper clad steel. Ground conductors shall be bare soft drawn stranded copper number 1/0 or larger. All connections between ground rods and ground conductors shall be exothermic welded.

C Construction

Install ground rods with ground whips to equipment noted as required by code. In addition, provide a minimum of three ground rods at each high mast lighting unit spaced a minimum of 20 feet apart and bonded together by a 1/0 ground wire. Provide a ground conductor from the base of this ground grid to the ground rod at the top of the high mast tower structure.

All conductors and ground grids shall be installed with a minimum of 12 inches of cover in areas with vegetative growth to allow the soil to maintain high moisture content.

Test ground grids by the contractor using the fall of potential method. Results shall be recorded and submitted to the engineer for review. Any readings below 10 ohms shall be given to the engineer immediately for further action.

D Measurement

The department will measure Lightning Protection and Grounding System as a single lump sum unit of work, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.108	Lightning Protection and Grounding System	LS

Payment is full compensation for furnishing and installing system, for testing system, and incidentals necessary to complete the work.

49. Weigh-In-Motion System, Item SPV.0105.200.

Summary

- 1 Introduction
- 2 Submittals
- 3 Mainline & Ramp WIM Operational Overview
 - 3.1 Mainline WIM System
 - 3.2 Mainline Lane Control System
 - 3.3 Mainline Compliance System
 - 3.4 Enforcement Camera Systems
 - 3.5 Ramp WIM System
 - 3.6 Ramp Lane Control System
 - 3.7 Mainline WIM and Lane Control Settings
 - 3.8 Data Collection System
 - 3.8.1 Capabilities
 - 3.8.2 Information Available
- 4 Virtual Weigh Station System Operational Overview
- 5 WIM System Functional Requirements
 - 5.1 Mainline
 - 5.1.1 WIM Scales
 - 5.1.2 WIM Load Cells
 - 5.1.3 Axle Sensors
 - 5.1.4 Detector Loops
 - 5.1.5 Compliance System
 - 5.1.6 WIM Electronics
 - 5.1.7 Overview Camera System
 - 5.1.8 LPR Reader
 - 5.1.9 Automatic USDOT Reading System
 - 5.1.10 Local Credential Repository
 - 5.1.11 Changeable Message Signs (CMS)
 - 5.2 Ramp
 - 5.2.1 WIM Scales
 - 5.2.2 Axle Sensors
 - 5.2.3 Detector Loops
 - 5.2.4 Electronics
 - 5.2.5 LCS
 - 5.2.6 Variable Message Signs (VMS)
 - 5.3 Scale House
 - 5.3.1 Operator Display
 - 5.3.2 Station Controls
 - 5.3.3 Manual Override Console

	5.4	Station Computer
	5.5	Scale Manager
6		Virtual Weigh Station WIM System Functional Requirements
	6.1	WIM Scales
	6.2	WIM Load Cells
	6.3	Axle Sensors
	6.4	Loop Detectors
	6.5	WIM Electronics
	6.6	WIM Scale Autocalibration
	6.7	Camera System
	6.8	Communications
	6.9	Portable Static Wheel Load Scales
	6.10	Portable Manual Test Stand For Portable Scale Calibration
7		Conduit and Pull Boxes
8		System Acceptance
	8.1	System Review
	8.2	Acceptance Tests
		8.2.1 Factory Acceptance Tests
		8.2.2 Site Acceptance Tests
		8.2.3 Continuous Operating Test (COT)
9		Training
10		Warranty
11		Materials
12		Standard Products
13		Lightning Protection
14		Measurement
15		Payment

1 Introduction

Install a Weigh-In-Motion (WIM) Sorting System to be utilized at the Sparta SWEF (Safety and Weight Enforcement Facility) to pre-weigh vehicles and provide direction to vehicles in motion as they approach along the mainline towards the Weigh Station. Changeable Message Signs (CMS) will be utilized along the mainline to direct vehicles to report or bypass the weigh station based on their perceived level of compliance as determined from the mainline pre-screening WIM system. The system will also include Open/Closed CMS signs, weigh station Changeable Message Signs (CMS) and Variable Message Signs (VMS).

A vehicle that has been directed to enter the weigh station will be screened once more on the ramp. Based on the results of this second screening, automatic directional signals shall direct the vehicle to either bypass or report to the scale house for further inspection.

The sorting decisions will be based on compliance of speed, side to side balance, axle-to-axle balance within tandem, axle spacing, axle weights, axle group weights, bridge formula (front and rear), gross vehicle weights with the pre-set tolerances and credentials.

This system shall also consist of one Virtual Weigh Station (VWS) located on STH 16. This proposed Virtual Weigh Station System will provide coverage of the bypass route for the Sparta SWEF, and therefore shall provide information regarding commercial vehicles bypassing the station.

As part of this project, Wisconsin DOT will be deploying PrePass and Drivewyze E-Screening Systems to interface with the mainline WIM Sorting Systems. The WIM Vendor must be able to successfully interface with the E-Screening System and provide consistent messages when notifying vehicles. This must be a fully integrated system.

The Mainline and Ramp WIM Systems shall include various components that interact together. The components shall include the following:

- Weigh-In-Motion (WIM) Scales
- Overview image video capture
- Lane directional signals for Mainline and Ramp Systems
- Weigh station computer system
 - Virtual Graphics Display
 - Scale Manager
 - Vehicle Display
 - Station PC
 - Override Console
- Axle and Loop detection
- Printer
- Weigh Station Variable Message Signs (VMS)
- Weigh Station Changeable Message Signs (CMS)
- Open/Closed CMS Signs
- On-site Communication System
- AVI (automatic vehicle identification) with Pre-pass Interface
- Automatic USDOT Reading (AUR) System with optical character recognition
- License Plate Reading (LPR) System with optical character recognition
- Local credential repository

The Virtual Weigh Station System shall include various components that interact together. The components shall include the following:

- Weigh-in-motion (WIM) scales
- Axle and loop detection
- Overview image video capture
- WIM computer system
- On-site communication system
- Portable static wheel load scales

The scope of work is to supply and install the following:

- WIM scales, axle sensing, loops, WIM electronics and cabinets
- Lane directional signals including support structures for the Mainline and Ramp Systems

- Overview image camera installation including support structures
- AUR system installation including support structures
- LPR system installation including support structures
- Tracking loops to activate lane directional signals and monitor traffic flow downstream of lane directional signals
- New communications conduit and wiring for all new equipment
- Electrical power wiring and conduit
- Weigh station Variable Message Signs (VMS) including support structures
- Open/Closed Signs (2) including support structures
- On-site Communication System
- High-speed Internet service and connection (STH 16 VWS)
- Monitoring capability and equipment at Sparta SWEF
- Portable static wheel load scales (2 sets)
- Portable Manual Test Stand For Portable Scale Calibration

The objective of the department is to have a fully operational Mainline and Ramp Sorting Systems, as well as a Virtual Weigh Station System, capable of accurately and automatically pre-screening vehicles in motion for enforcement purposes. Based on the weights obtained from the WIM screening, the system shall automatically direct the selected vehicles to the enforcement scales, as illustrated in the attached plans and these specifications.

The purpose of this project is not for the research and development of a system which might perform the objectives as described above. Therefore the Contractor shall be required to furnish documentation which demonstrates to the satisfaction of the department that all equipment proposed for use in the Mainline, Ramp and Virtual Weigh Station WIM Systems is of standard manufacture; that the manufacturer has had similar equipment available for purchase for not less than ten years; and has a proven acceptable performance history while in use under conditions similar to those for the intended use.

2 Submittals

Prior to manufacturer approval, the contractor and the engineer shall arrange the following:

1. The contractor shall furnish electronically collected accuracy performance data from the pre-existing system to the Engineer. This data shall be in a common database and include WIM records (axle and gross) and static (platforms and gross) weights that have been electronically collected (manually entered data will not be accepted). This report shall contain at least 20,000 vehicle records.
2. The contractor shall furnish 3rd party verification of the static scale system passing an 80,000 amperes lightning strike test.
3. The contractor shall arrange for the demonstration of a pre-existing SYSTEM to the Engineer at least two weeks prior to the pre-construction conference.
4. The engineer may, at its option and expense, make provision for selected persons to view the demonstration.

At the pre-construction conference, the Contractor shall furnish:

1. The engineer with written documentation and information of the WIM and static scales.
 - a. Manufacturer's name
 - b. Model number, supported by descriptive material for, but not limited to, the standard package system
 - c. All accessories identified
2. Submittals shall be supported by descriptive material such as:
 - a. Catalogs
 - b. Cuts
 - c. Diagrams
 - d. Other data published by the manufacturer, to demonstrate to the engineer the contractor's intent to comply with the technical special provisions and plan requirements.
3. List a minimum of five weigh stations and provide the owner's name, address, persons to contact and telephone numbers of similar enforcement installations in the United States.

The system manufacturer shall submit the following:

1. Equipment drawings
2. General arrangements
3. Foundation requirements including camera reader pole, CMS structures, LMS signals structure, static and bypass VMS structures. All foundations to be stamped by a PE licensed in Wisconsin.
4. Circuit diagrams
5. Field wiring diagrams
6. Instruction manuals
7. Bill of Materials
8. Spare parts list
9. Manufacturer's product data
10. Certified test reports
11. Material certifications

The contractor shall submit the following equipment documentation for acceptance prior to fabrication:

1. Detailed description of how the System requirements are met, including a step- by- step description of how the System would function in processing each of the following violations as well as the compliant scenario
 - a. Overweight
 - b. Off-scale
 - c. Manual override of the system for truck selection either programmed or random
 - d. Compliant
 - e. Over-length
 - f. King Pin Violator

- g. Back parking lot/inspection traffic
- h. Imbalance
 - 1) Side to side
 - 2) Axle to axle within a tandem

2. Inductive loops, according to the contract documents

The contractor shall submit six complete sets of full size drawings. The contractor shall:

- 1. Design all overhead structures and foundation supports including Open/Closed sign structure, camera reader pole, CMS structures, LMS signals structure, static and bypass VMS structures. All foundations to be stamped by a PE licensed in Wisconsin.
- 2. Submit shop drawings along with the supporting calculations to the Engineer for review and approval.
- 3. Obtain a professional engineer registered in the State to document, sign and seal all structural drawings.

Two weeks prior to the Continuous Operating Test (COT), the contractor shall supply the following to the engineer for the maintenance of the system:

- 1. Narrative description of system operation in detail.
- 2. Narrative technical description of the following:
 - a. Major system component interaction
 - b. Subsystem component interaction
- 3. Drawings:
 - a. Major system component operation/interconnection
 - b. Internal Printed Circuit Board (PCB) operation detailing what electronic function and process is being performed on that board
- 4. Schematics shall reveal diagrams related to troubleshooting/maintenance including:
 - a. Input and output voltage levels on WIM related PCBs
 - b. Voltage test points at various stages on the WIM process
 - c. Data sheets on any specialized proprietary Integrated Circuits (IC's) or boards in the system
 - d. Jumper and switch settings on all PCB's for normal operation
 - e. As-built drawings shall show type and location of all conduits, pull boxes, junction boxes, loops, traffic signs, directional signals and PA speakers
- 5. Technical documentation on all accessories used in the system (Open/Closed signs, directional signals, etc.).
- 6. Contractor shall provide names and phone numbers of contacts that user may contact for technical help

Acceptance of bid or approval of shop drawings by the engineer does not relieve the Contractor of the responsibility or the necessity of furnishing material and/or performing

work as required by the plans and these provisions, nor from the requirements of the Continuous Operating Test (COT) as contained within these provisions.

The equipment approved by the engineer shall be provided and installed according to the plans and these provisions. Should the equipment proposed by the contractor become unavailable, the engineer may approve in writing alternate equipment proposed by the contractor due to the unavailability of the originally specified equipment.

3 Mainline & Ramp WIM Operational Overview

The Mainline and Ramp WIM Sorting Systems shall consist of the following subsystems:

1. Mainline WIM System
2. Mainline Lane Control System
3. Mainline Compliance System
4. Enforcement Camera System
5. Ramp WIM System
6. WIM Scale Auto-Calibration
7. Ramp Lane Control System
8. Station Computer System including scale house subsystems
9. Data Collection System

3.1 Mainline WIM System

Commercial vehicles approaching the weigh station shall be directed into the right hand lane by means of static signing as provided by the Wisconsin Department of Transportation. A vehicle approaching the weigh station will pass over the Mainline Weigh-In-Motion (WIM) system, which is embedded in the highway prior to the weigh station exit ramp. The right lane will be equipped with WIM Scales that exceed ASTM E1318 Type III accuracy. WIM electronics will be located at the roadside adjacent to the WIM scales and sensors, and will process the information collected by the in-road equipment.

The WIM system will collect axle weight and spacing, vehicle speed, classification and other relevant data to create a vehicle record. An overview image of the passing vehicle will be combined with the vehicle record. A USDOT and License Plate image of the passing vehicle will also be combined with the vehicle record. Using optical character recognition the USDOT and license plate read will be included in the vehicle record. The license plate jurisdiction will be a part of the license plate read. The combination of USDOT, license plate number, and license plate jurisdiction will be checked against a local database on the weigh station computer for non-weight violations. Based on a comparison of the vehicle record to the parameters set by the station system, the WIM system will make a sort decision and advise the driver to either exit or bypass the weigh station via the Changeable Message Signs (CMS) located on the side of the road. However, the actual sorting operation can be overridden by the operator using the virtual graphics display or override control in the weigh station. Non-violating vehicles may be randomly selected from the mainline for visual inspection at the scale house.

An AVI detection system shall be included to identify PrePass vehicles. This shall be provided separately by PrePass, but shall be integrated into the WIM check system. The Mainline WIM system will be such that a vehicle may be called in to report based on its PrePass credential check, as well as its WIM weight check.

A vehicle classification system shall be installed in the left lane in order to detect commercial vehicles bypassing the scales in the right lane.

3.2 Mainline Lane Control System

Changeable Message Signs (CMS) shall be used to communicate with the driver after a mainline vehicle analysis has been completed. The Lane Control System (LCS) shall consist of two changeable message signs and three inductive loops, which are installed along the side of the roadway downstream from the advance WIM system. The LCS system shall be controlled by the roadside WIM electronics, which receives the sort decision from the Station Computer. The LCS system ensures that the sign ON/OFF switching is synchronized according to the detection and tracking of a vehicle passing over strategically placed loops. In this way, only the vehicle for which the message is intended will see the illuminated sign.

The WIM Vendor will co-ordinate efforts with PrePass and Drivewyze to ensure that no conflict occurs within the signing sets, i.e., there shall be no contradictions between the roadside signs and the in-cab transponders.

Typical roadside sign messages are as follows:

Message 1: TRUCK MUST EXIT
TO WEIGH STATION

OR

Message 2: TRUCK BYPASS
WEIGH STATION

The components of the system shall provide heartbeat communications so the system's health can be monitored.

3.3 Mainline Compliance System

A compliance system shall be located on both lanes of the mainline downstream of the ramp exits. The system shall consist of a set of piezoelectric vehicle classification configurations to track the commercial vehicles that bypass the weigh station in the passing lane. A set of piezoelectric quartz sensors for vehicle classification and weight verification will be installed and used in the driving lane. A WIM scale shall also be located on the exit ramp in order complete the vehicle tracking system.

All vehicle information, including violation information, will be determined in real time and shall be displayed on the scale house operator console in vehicle display windows.

The components of the system shall provide heartbeat communications so the Systems health can be monitored

3.4 Enforcement Camera Systems

The enforcement camera system will consist of an overview image camera, license plate reader, and automated USDOT reader (AUR) mounted alongside the roadway on the mainline. The overview camera system will capture an image of passing commercial vehicles to be linked with the vehicle record as an identifier. The camera will be capable of full color photos during daytime operation, and black-and-white near-infrared images during nighttime operation. The camera system electronics, which will be located with the other System Electronics, will store the image and will link it with the correct vehicle record.

The LPR system will capture an image of the commercial vehicles license plate to be linked with the vehicle record. The camera will be capable of black-and-white near-infrared images during daytime and nighttime operation. The camera system electronics, which will be located with the other System Electronics, will store the image and will link it with the correct vehicle record.

The AUR system will capture an image of the commercial vehicles USDOT number to be linked with the vehicle record. The camera will be capable of black-and-white near-infrared images during daytime and night time operation. The camera system electronics, which will be located with the other System Electronics, will store the image and will link it with the correct vehicle record.

3.5 Ramp WIM System

The accuracy of the WIM system shall exceed ASTM E1318 Type III “Standard Specifications for Highway Weigh-in-Motion (WIM) Systems. Calibration and accuracy tests shall be performed as specified below. The contractor shall ensure the roadway meets the requirements of Section 6 of ASTM E1318.

The WIM system shall be provided with a roadside cabinet to house the WIM electronics. The WIM computer and its peripherals may optionally be installed inside the scale building.

As commercial vehicles enter the weigh station exit ramp, the sorter system will continuously and automatically verify the trucks vehicle record from the mainline system. The WIM System will determine whether the vehicle is compliant. Violating Pre-Pass vehicles from the mainline will be directed to report to the static scale via an in-cab transponder notification. All vehicle information, including violation information, will be determined in real time and shall be displayed on the scale house Vehicle Display Windows on the central Station Computer.

The system will function under either manual or automatic control. Under automatic control, the compliance system will automatically direct a suspected violator to the static weigh scales and compliant violators to exit the station. The virtual graphics display will be used to control the system and will allow the operator to direct all vehicles to either the scale or bypass lanes. The WIM system will not be able to direct vehicles according to vehicle information collected in this mode, but will continue to display vehicle information to the operator.

The system will have the ability to track the suspect violators using in-road inductive loops while on route to the static scales.

The Virtual Graphics Display will provide manual control to the Weigh Station for the operation of the Changeable Message Signs. The Open/Closed signs will be controlled by a physical switch on the Override Console.

The system should be able to collect continuous data on the vehicles entering the station for statistical analysis. The data collection system should save vehicle information in a compressed format complete with a date and time stamp. As a result, the information can be downloaded and, with the aid of commercially available software, the user will be able to generate reports based on user inputs. The stored data must be remotely accessible by cellular modem communications.

The components of the system shall provide heartbeat communications so the Systems health can be monitored.

3.6 Ramp Lane Control System

The ramp lane control system shall consist of an overhead LED sign system that is linked to the Ramp WIM system. This sign will display a green arrow ↓ to an oncoming truck if it is cleared to bypass the static scale; otherwise it will display a red X as a signal to report. Conversely, an oncoming truck will receive a red X to bypass and a green arrow ↓ to report for the scale lane. The signs shall have a dual-sided display, also visible to the scale house. The sign will be supported on a monotube/mast arm structure.

3.7 Mainline WIM and Lane Control Settings

Using the Central Weigh Station computer, the operator may set the sorting threshold and allow for random sorting. The sorting threshold determines at what percentage of legal weight a vehicle must be measured to be required to report. In this way, the operator may set the WIM to bring in the maximum number of trucks that the station can process, without exceeding the station capacity. Random sorting allows the operator to require a set percentage of compliant trucks to report. This allows the enforcement officials to perform random safety checks on otherwise compliant trucks.

The Central Weigh Station computer system will receive the WIM record from the roadside WIM electronics at the ramp location. The Weigh Station computer contains electronic records that will be used to ascertain weight compliance. After the Weigh Station computer creates the WIM record, it will immediately begin to analyze the data

contained in the record in order to determine whether the vehicle weights and dimensions are within local compliance regulations. If the measured vehicle weight is within the allowable limits, the driver will be given a bypass message through the ramp lane control system. If the vehicle is not compliant or if it is randomly selected for inspection, the driver will receive a message to report to the weigh station.

The central Weigh Station computer system will provide safety features to detect and prevent backups and unsafe conditions. These will include:

1. An audible message to alert operators of a backup at the ramp WIM scale in either direction.
2. Automatically close the station in a direction if a backup occurs on the exit ramp from IH 90. An audible message will sound to alert operators. Once the backup has cleared the station will automatically reopen in that direction.
3. Automatically sort all vehicles including violators to the bypass lane on static scale lane back up.

Operators will have the capability to override the automatic close and automatic sort to bypass on static lane back up feature on the Override console.

3.8 Data Collection System

Vehicle information is to be collected continuously by the roadside WIM electronics at the Mainline and Ramp WIM locations. This information shall be made available to the user and a variety of reports summarizing the data can be generated. This data can be shared between departments if the agency responsible for weight enforcement is separate from the roadway maintenance, planning and/or design departments.

3.8.1 Capabilities

An operator at the site may download the vehicle data directly from the roadside WIM System Electronics, or the data may be transferred to a remote location via modem.

Manufacturer host software can be used to automatically call one or several WIM systems to obtain traffic data from the site. The user configures the frequency of the calls and the information to be obtained. Once the data has been obtained, office analysis software capable of computing various classification schemes shall be used to provide various report capabilities based on the data collected. This system shall store a least 60 days of vehicle records (over 2 million vehicle records) in a compressed format.

3.8.2 Information Available

The following information shall be made available from the data collection feature of the Mainline and Ramp WIM systems:

- Reports over any selected time period in hourly increments, daily, weekly, or monthly.
- Summary of vehicle speeds.
- Summary of vehicle classification counts.
- Equivalent Single Axle Load (ESAL) count.

- Reports on the number of violating and non-violating axles, axle groups and gross vehicle weights.
- User selected reports based on adjustable parameters such as periods and vehicle types.
- Customization for generating reports for specific needs that are not available using basic parameters.

4 Virtual Weigh Station System Operational Overview

The Virtual Weigh Station System shall be located on STH 16, north of Bangor, WI between STH 162 and CTH E intersections, La Crosse County. This location shall provide coverage of commercial vehicle traffic on STH 16 and shall relay that information to the Sparta weigh station and to State Patrol inspectors on their laptop computers.

All vehicles approaching the Virtual Weigh Station System shall produce a vehicle record containing an overview image, various weights, and speed, as well as classification information. The Virtual Weigh Station System shall determine whether each vehicle is weight compliant based on its allowable weights as set by the weigh station operator.

The Virtual Weigh Station System shall trigger an overview image camera system to capture an image of each vehicle as it passes the WIM Scales and will link each image with the appropriate WIM vehicle record. The system shall provide an audible alert to make on the officers laptop if a violator is detected.

Based on the parameters set forth by the user, images of commercial vehicles can be collected and stored by the System Electronics and relayed to the weigh station for all violating commercial vehicles or for all vehicles. The user can also identify the selection criteria for a violating commercial vehicle, i.e. overweight, over length, speeding, etc.

The combined data (image and vehicle record) will be accessible to any computer with secure network access to view the captured images and vehicle records of the suspected violating vehicles. The system shall be password protected.

The system shall allow State Patrol officers to select a vehicle and view a detailed view of the record. In this view the system shall show a larger image of the vehicle with zoom in capabilities to better view of the vehicle details.

The system shall also allow State Patrol officers to enter weights for vehicles when they weigh them statically and print a ticket.

The system shall allow historical searching of violating vehicles from its web pages by date range. The results should be sortable by vehicle id, license plate number, weight violation, speed, lane, class, travel direction, and date and time.

5 WIM System Functional Requirements

5.1 Mainline

5.1.1 WIM Scales

The accuracy of the WIM system shall exceed ASTM E1318 “Standard Specifications for Highway Weigh-in-Motion (WIM) Systems performance requirements for a Type III system. The WIM accuracy on all vehicles loaded above 60,000 pounds and traveling between the speeds of 5 to 85 miles per hour shall be:

1. Axle weights + 12% (95% of trucks)
2. Tandem weights + 8% (95% of trucks)
3. Gross weights + 4% (95% of trucks)
4. Axle spacing + 6 inches or 5% (68% of axles), whichever is greater

Blanket grind the existing concrete pavement in the mainline drive lane beginning 200 feet prior to the WIM scale location and ending 100 feet after the WIM scale location, for a total of 300 feet, with a minimum 36 inch blanket grinder to ensure that the roadway meets the requirements of Section 6 of ASTM E1318 prior to installation of the WIM system.

The WIM scales shall be constructed of two independent weighing platforms placed in each lane of the roadway. The WIM scales shall use load cells meeting the requirements below. WIM scales that are bending plate, strain gauge or a load cell weigh pad are not acceptable. The WIM scales shall measure approximately 144-inch x 38-inch including frame.

Each scale module shall be a self-contained weighing unit. Each scale module shall measure approximately 72-inch x 38-inch including frame. Each scale will have a weighing capacity of 50,000 lbs (single axle). Each has a static weighing accuracy of 1% or better as demonstrated by applying certified test weights in three places on each platform – each side and center.

There shall be two scale frames into which the two scale modules are mounted. Install the WIM scale flush with the road surface.

The WIM scales shall operate properly in a temperature range of -40°F to +160°F. The WIM scales and their frames shall be hot dip galvanized for protection according to ASTM A123. All installation hardware shall be either stainless steel or hot dip galvanized. All surface mounting bolt and service holes shall be sealed.

The WIM scale shall be weather-sealed. Any water, ice, snow, salt, debris, dirt, moisture, or sand shall not degrade scale performance.

The design of the WIM scales is to be such to provide a fatigue life of 15 years based on weighing 10,000 trucks per day with 40,000 pound dual tandem axles

Ground the WIM scales and frames as per manufacturer’s recommendations. Protect the signal processing and electronics/modules against lightning.

Replacement of any load cell shall be accomplished within one (1) hour. The WIM scale shall not require calibration after replacement of a load cell.

5.1.2 WIM Load Cells

The WIM load cells shall strictly meet the following requirements:

1. Constructed of 17-4 stainless steel construction.
2. Hermetically sealed NEMA 6P IP 67 rated.
3. Have temperature compensation inherent to the load cell design.
4. Span temperature coefficient of 100 PPM/degrees Celsius.
5. Zero temperature coefficient of 300 PPM/degrees Celsius.
6. Loading and unloading time not to exceed 60 seconds each.
7. Provide lightning and surge protection.
8. The load cell cables for the WIM scales shall be stainless steel braided cable to prevent damage by rodents.

5.1.3 Axle Sensors

The Mainline WIM system may use axle sensors in each lane for WIM or classification operation. If used, the axle sensors shall be Class I piezoelectric and approximately 12 feet in length.

The axle sensors shall be installed below the road surface. The axle sensors and their electrical wiring connector shall be completely water tight and sealed.

5.1.4 Detector Loops

Each detector loop shall have a minimum loop area of 6-foot x 6-foot. Detector loops shall conform to WisDOT standard specifications.

Loop wire shall be 1 conductor, 14 AWG, IMSA 51-5. Loop leads shall be 2 conductor, 14 gauge, IMSA 50-2 cable.

Loops shall not be cut directly into the existing roadway and loop sawcuts will not be exposed to the roadway surface. In situations where the roadway is PCC and is not continuously reinforced, the appropriate PCC section of roadway will be removed, loops will be installed, and the appropriate PCC section will be replaced. In situations where the roadway is 3 1/2 inch AC overlay on top of continuously reinforced PCC, the existing 3 1/2 inch AC overlay will be milled down to PCC, loops will be installed within the PCC base, and the entire area will be replaced with a 3 1/2 inch of AC overlay (mill and replace).

Detector loops shall be provided in order to control signals and for the system to operate as described in these special provisions. Loop detectors shall be installed in the WIM system electronics of the mainline WIM and ramp WIM systems. The mainline WIM and ramp WIM systems shall use the signals from these detector loops to switch the message of signs and signals throughout the system and to track vehicles. CMS signs shall be switched in a tracking sequence to direct a sorted vehicle to enter the weigh station.

5.1.5 Compliance System

The compliance system shall consist of vehicle detection loops, axle sensors and WIM sensors in the following configuration:

"loop -- axle sensor – axle sensor -- loop".

The compliance system shall monitor vehicles signaled to bypass or report the Weigh Station. It will be interfaced to the Station Computer.

An audible alarm will be sounded on the Virtual graphics display in the event that a commercial vehicle does not take the lane as directed by the Lane Control Signals.

5.1.6 WIM Electronics

The System Electronics shall be capable of receiving and analyzing the data gathered from the Mainline and Ramp WIM Sorting System locations. The Electronics shall also be responsible for communicating and transmitting vehicle weight data from the WIM site to the station Computer in the SWEF building.

The System Electronics shall be capable of receiving inputs from the WIM scales, loops and piezoelectric sensors, as well as serial and digital devices. Output control options shall be included for a variety of serial, digital and AC power devices, such as CMS, LCS and printers.

The system shall be compatible with automatic vehicle identification (AVI) equipment, as specified by PrePass, including communications ports and software.

All sensor modules shall be field replaceable and every module shall feature self-testing and built-in fault diagnosis.

The Mainline WIM system shall be provided with a roadside cabinet to house the System Electronics and the overview image freeze frame camera equipment, the LPR equipment, the AUR equipment, and other system peripherals. The Ramp WIM cabinet will have System Electronics, as well as the other system peripherals for the location. The electronics for the AVI reader located on the Mainline WIM section shall be supplied by PrePass.

The roadside cabinets shall be lined and insulated and shall be installed with a fan and heater. All cutouts and openings shall be vermin proofed.

All wires from scales, off-scale sensors, axle sensors, loops, sign control lines, shall be terminated on terminal strips or screw terminal connectors. The terminal strips shall be identified by terminal strip number and screw connection number. These terminal strips shall be readily accessible. All cables shall be long enough to easily reach these terminal strips. Terminal strips, splices, or other type of connections prior to these standard terminal strips shall not be allowed except for splicing of a loop to a shielded twisted loop lead.

All AC power connections shall be shielded to prevent electrical shock.

The System Electronics shall abide by the following requirements:

1. Communications
 - a. On-board Ethernet interface (wireless or fiber)
 - b. One RS-232 serial interface dedicated to external interface.
 - c. Local user interface for system configuration and fault diagnosis.
 - d. Remote administration via Telnet or Windows remote desktop.
 - e. Remote file download via FTP.
2. Peripherals
 - a. Non-volatile storage for vehicle information to prevent data loss during power outages:
 - b. Sensor inputs from WIM Scale, loops and Piezos.
 - c. Output control for CMS and LCS.
3. Software
 - a. Records data logs on operational status, condition and safety system activity.
 - b. Weight Compliance and Classification with user-defined classification scheme.
 - c. Serial output compatible with Help, I75 and others.
 - d. Automated Mainline and Ramp Weigh Stations.
 - e. Data Analysis and Reporting.
4. Digital I/O Module
 - a. Report on rising edge, falling edge or both.
 - b. Adjustable input debounce.
 - c. Control output state, single pulse, or square wave
 - d. Adjustable timeout on inputs

5.1.7 Overview Camera System

The Overview Camera System shall consist of the following system components:

1. Color and Black/White video camera
2. Illuminator system
3. Video capture system

The Overview Camera System shall monitor traffic flow on the mainline. It shall capture still images of trucks having violations for identification and enforcement purposes. The images shall be displayed on an operator interface located in the scale house. Each vehicle record number shall be displayed with the vehicle image.

One camera shall be provided and installed on a pole located near the Mainline WIM location. The camera shall provide overview images of the passing commercial vehicles, detailing their cab and side. Color images shall be provided for daylight use, and black/white images shall be provided for night use.

The overview capture system shall be located in one of the System Electronics. The overview capture system shall provide control and display facility to display image outputs from one source to one monitor.

The camera poles and bases shall conform to the requirements of standard spec 657 and standard spec 672.

5.1.8 LPR System

The LPR system shall be capable of collecting, storing, and transmitting all commercial vehicle license plate images and OCR data to the Station computer for configurable periods. The OCR read accuracy on license plates shall meet 90% of readable plates including jurisdiction including at night.

5.1.9 Automatic USDOT Reading System

The AUR system shall be capable of collecting, storing, and transmitting all commercial vehicle license plate images and OCR data to the Station computer for configurable periods. The OCR read accuracy on license plates shall meet 75% of readable numbers.

5.1.10 Local Credential Repository

The system manufacturer will provide a local database that can hold PRISM and CVIEW data to be used to query LPR and DOT reads against. The State will assist in getting the system manufacturer setup with FMCSA to receive PRISM and CVIEW data files. The system manufacturer will be responsible for connecting, downloading, and updating the database on a daily basis.

5.1.11 Changeable Message Signs (CMS)

The Mainline Lane Control System (LCS) shall consist of the following system components:

1. 2 x Changeable Message Signs (CMS)
2. Detector loops as needed to track vehicle compliance.

The LCS shall direct vehicles to enter the weigh station or bypass the station, based on the results of the mainline sort decision.

The LCS shall consist of two CMSs that are sequentially switched by the Mainline WIM system. The LCS, under control of the Mainline WIM system, shall synchronize the sign switching upon detection of the tracked vehicle passing over or through strategically located detector loops.

The LCS, under control of the Mainline WIM system, shall also be consistent with the PrePass notification signal to the PrePass in-cab transponder. The WIM System, upon notification from PrePass, shall blank all CMS such that all messages regarding truck compliance and reporting instructions are decided by PrePass and communicated via transponder.

Each CMS shall be capable of displaying the following two messages:

Message 1:
TRUCK MUST EXIT
TO WEIGH STATION

Message 2:
TRUCK OK TO BYPASS
WEIGH STATION

Each message character shall be 10 inches high. The sign shall have a viewing angle of 90 degrees horizontally, and 40 degrees vertically.

The CMS shall be mounted on breakaway steel sign supports conforming to the requirements of standard spec 635 and standard spec 636. Concrete bases along the mainline shall be a minimum of 32 feet from the edge of travel lane and flush with the surrounding ground.

The messages must be clear and legible under any lighting conditions. When not energized, the sign shall completely blank out without any ghost images.

Furnish, install and make operational LED OPEN/CLOSED and $\nearrow$ /CLOSED CMS inserts on WEIGH STATION signs.

5.2 Ramp

5.2.1 WIM Scales

The Ramp WIM scales and their load cells shall be the same as the Mainline WIM scales and meet the requirements specified in sections 5.1.1 and 5.1.2.

5.2.2 Axle Sensors

The Ramp WIM system may use axle sensors in the ramp exit lane for WIM operation prior to the point where the roadway splits into two lanes. If used, the axle sensors shall be Class I piezoelectric and approximately 12 feet in length.

The axle sensors shall be installed below the road surface. The axle sensors and their electrical wiring connector shall be completely watertight and sealed.

5.2.3 Detector Loops

Each detector loop shall have a minimum loop area of 6-foot x 6-foot. Detector loops shall conform to WisDOT standard specifications.

Loop wire shall be 1-conductor, 14 AWG, IMSA 51-5. Loop leads must be 2-conductor, 14 gauge, IMSA 50-2 cable.

Loops shall not be cut directly into the existing roadway and loop sawcuts will not be exposed to the roadway surface. In situations where the roadway is PCC and is not continuously reinforced, the appropriate PCC section of roadway will be removed, loops will be installed, and the appropriate PCC section will be replaced. In situations where the roadway is 3 1/2-inch AC overlay on top of continuously reinforced PCC, the existing 3 1/2- inch AC overlay will be milled down to PCC, loops will be installed within the PCC base, and the entire area will be replaced with a 3 1/2-inch of AC overlay (mill and replace).

For each VMS/CMS there shall be a detector loop. Loop detectors shall be provided for interface to these detector loops.

The Ramp system shall use signals from these loops to switch the lane directional signals and the CMS located downstream of the Static Scale.

5.2.4 Electronics

The Weigh-In-Motion (WIM) Interface Electronics shall be located next to the weigh in motion scales in a roadside cabinet. The weigh in motion electronics will be responsible for retrieving truck data and communicating it to the sorter computer in the scale house.

The electronics should include interfaces to the following components:

1. Weigh-in-Motion scales
2. Axle sensors
3. Loops
4. Off-scale detectors
5. Operator display
6. Lane directional signals
7. Weigh Station Computer system

The electronic system must be of a modular design to aid in system maintenance, troubleshooting and in-field servicing.

All components of the electronic system, including inductive loop detectors, shall contain necessary electrical protection to prevent damage from electrical surges, spikes and the effects of lightning.

The system must be of a durable, industrial design and construction and enable continuous operation, with automated startup in the event of a power outage.

All sensor and ancillary equipment connections must be conveniently located on the system front panel. All connections, where possible, should be a plug-in, quick-connect style.

Where possible, all printed circuit boards and components should be of a commercially available design. This includes, but is not limited to; the system central processing unit (motherboard) and CPU related interfaces such as digital input/output interfaces.

The specifications for the Ramp WIM system electronics are to follow the minimum specifications as set out for the Mainline WIM Electronics.

All cutouts and openings in the electronics housing cabinet shall be vermin proofed.

All wires from scales, off-scale sensors, axle sensors, loops, sign control lines, shall be terminated on terminal strips or screw terminal connections. The terminal strips shall be identified by terminal strip number and screw connection number. These terminal strips shall be readily accessible. All cables shall be long enough to easily reach these terminal strips. Terminal strips, splices, or other type of connections prior to these standard terminal strips shall not be allowed except for splicing of a loop to a shielded twisted loop lead. All AC power connections shall be shielded to prevent electrical shock.

5.2.5 LCS

A Lane Control System (LCS) shall be located on the ramps prior to the sorting point. Each Lane Control System consists of the following components:

- Two Directional Signals, with Red “X” and Green “ARROW” ↓ graphics.
- The directional signals will be two sided so they can be viewed from the building.
- Support Structures and base to suspend the signals (as listed in a) above the lanes of travel.
- A pole and base will provide support for signals.

The LCS CMS shall abide by the same requirements as specified in section 4.1.7 (CMS Specifications).

The support structure and base will be designed to meet Department structural requirements and shall be approved by a licensed PE in Wisconsin.

5.2.6 Variable Message Signs (VMS)

Two variable message signs shall be located downstream of the static scale and mounted on an overhead pole or poles. All VMSs shall be constructed using the same technology.

The VMS mounted over the left lane shall display a static “LEFT LANE” sign (black on white) above the VMS and shall have the following message options:

Message 1:

PULL ONTO

SCALE - in yellow with animation

Message 2:

PULL FORWARD

SLOWLY – in yellow

This message will be displayed until the truck hits the point on the static scale where it needs to be stopped to be properly positioned.

Message 3:

STOP – in red with animation

This message will be displayed to automatically stop the truck on the static scale for proper weighing

Message 4:

STOP – in red, static

Message 5:

BACK UP

SLOWLY – in yellow

Message 6:

OK

GO AHEAD – in green

Message 7:

PARK IN LOT – in green

Message 8:

REPORT FOR

INSPECTION – in green

Message 9:

PULL INTO

BAY 1 – in green

Message 10:

PULL INTO

BAY 2 – in green

Other messages as determined by the scale operator.

The VMS mounted over the right lane shall display a static “RIGHT LANE” sign (black on white) above the VMS and shall have the following message options:

Message 1:

STOP – in red

Message 2:

OK GO AHEAD – in green

Message 3:

SLOW DOWN - in yellow with animation

Message 4:

25 MPH - in yellow

The system shall have the capability to create or edit messages. A message shall be displayed for every commercial vehicle.

Each message character shall be at least 6 inches high. The sign shall have a viewing angle of 90 degrees horizontally, and 40 degrees vertically. Messages shall be programmable via computer in the scale house and be:

1. Password protected.
2. A message shall not exceed two lines of 16 characters per line.
3. Shall store minimum 20 messages.
4. Allow for six active messages.
5. Active messages shall be controllable via static scale program, static scale mouse, keyboard, or graphics panel.

Each sign shall have color capacity of 256 or more colors. Each sign shall have 3 LEDs per pixel (1 red, 1 green, 1 blue). Each sign shall have an estimated life of 100,000 hours plus. Each sign shall have front access.

Each sign shall be capable of displaying text, graphics, logos, basic animation, multiple font styles and sizes.

VMS signs shall be powered by 120/240 VAC single phase.

VMS signs shall be capable of communicating via RS232, RS422, modem, serial fiber, or Ethernet fiber.

VMS sign shall have 64 levels of display dimming (automatic or manual control).

The VMS shall be mounted on a breakaway steel sign support which meets crash requirements as set forth by NCHRP 350 and approved by an engineer licensed in the state of Wisconsin. Concrete bases shall be flush with the surrounding ground.

The messages must be clear and legible under any lighting conditions. When not energized, the sign shall completely blank out without any ghost images.

5.3 Scale House

5.3.1 Weigh Station System Operational Overview

The Weigh Station system shall be located in the scale house and will collect data from the Mainline and Ramp WIM electronics and static scale, for central monitoring and control of the facility operation. The system shall provide two operator displays at the scale house. The operator can monitor vehicle movements, view and print reports and adjust system parameters, i.e., alter message signs, adjust random sorting %, adjust overweight %, etc.

The Weigh Station System will be made up of the following components:

- Vehicle Display Window (displays will vary by manufacturer)
- A Virtual Graphics Display
- An Override Console
- A Central Station Computer
- Static Scale Manager

5.3.2 Vehicle Display Windows

The Vehicle Display Window shall display:

- sequence number
- time and date
- class
- speed
- gross vehicle weight
- lane-time and date
- direction of travel
- OCR read of the vehicles license plate and jurisdiction
- OCR read of the vehicles USDOT number
- violations highlighted in red
- right and left wheel weights per axle with violations highlighted in red
- individual axle weights with violations highlighted in red
- individual, front bridge, rear bridge, and full vehicle spacing
- tandem weights as measured by the WIM electronics with violations highlighted in red
- front and rear bridge weights as measured by the WIM electronics with violations highlighted in red
- thumbnail image of the vehicle from the overview camera
- thumbnail image of the USDOT number
- thumbnail image of the vehicle license plate

A vehicle record shall be displayable in either graphic form or in text form. Another alternate shall be a tabular view of all records in the queue.

The length from axle to axle shall be shown on a linear scale with axle spacings plotted below the scale line. Red text for an axle shall indicate the location of an overweight axle or axle group.

The display of vehicle record must show the following violation information in addition to dimension and weight violations:

1. Off-scale – The off-scale detector was triggered during the weighing operation
2. Vehicle speeding
3. Overheight
4. Credential

The vehicle display windows shall allow the following options at any time without going to alternate screens or menus:

1. Freeze vehicle record
2. Print vehicle record
3. Double click on the overview thumbnail image to see a larger view

Each vehicle record shall contain a digital image of all vehicles and shall be similar to the following examples.

747 15:21:51 Class:9 Speed:36 Gross:81400 Plate:2VG154 ST:OK USDOT:1202
 AxleOverWt BridgeOverWt TndmOverWt GrossOverWt Credential

```

1.....2...3.....4...5
|-----17.5-----|4.3|-----35.1-----|4.0|
|-----21.8-----|
|
|-----43.4-----|
|-----60.9-----|
  
```

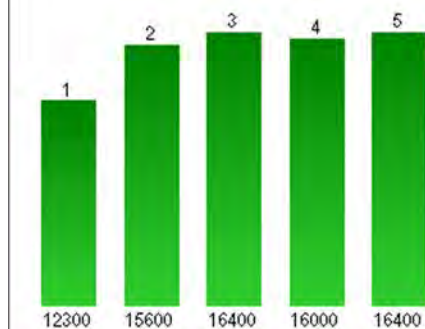
Axle	1	2	3	4	5
RGHT	5700	8200	8400	7600	10100
LEFT	6100	7800	8300	9000	10200
TOTL	11800	16000	16700	16600	20300
Tndm:		32700		36900	
InBr:	1-3 44500	2-5 69600			



740 15:16:56 Class:9 Speed:38 Gross:76700 Plate:A014978 ST:MS USDOT:237655
 Credential

```

1.....2...3.....4.....5
|-----19.0-----|4.3|-----29.8-----|10.0--|
|-----23.3-----|
|-----34.1-----|
|-----63.1-----|
  
```



5.3.3 Virtual Graphics Display

The Virtual Graphics Display shall provide software representing the overhead layout of the station on the central Weigh Station Computer to provide control and monitoring of the station. The Station Console shall provide the ability for an operator in the weigh station to select the control operation of each the Mainline and Ramp LCS manually. The graphics display shall have visual indicators to identify the mode of control of each LCS. In

addition vehicle movement information will be displayed using indicators on the graphical panel. It shall provide the following functions:

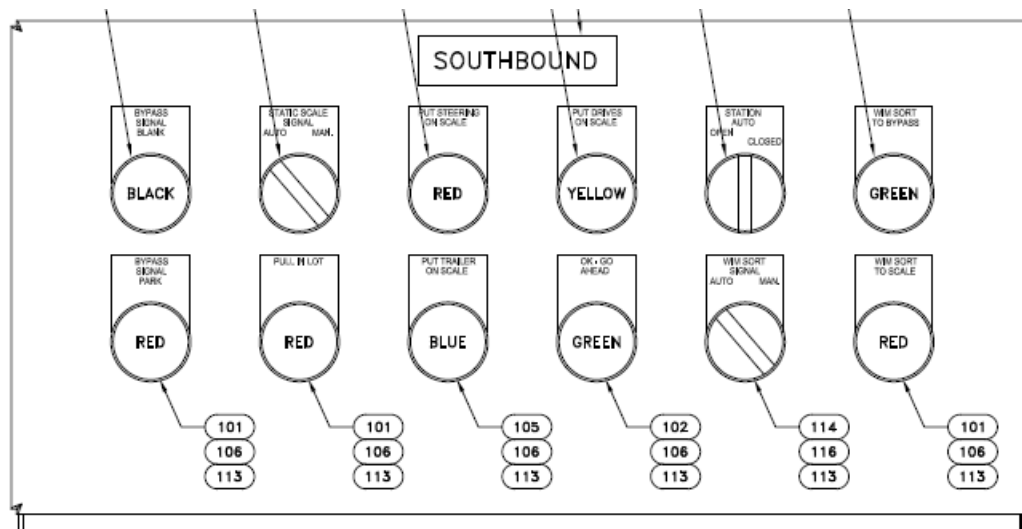
1. Select automatic sort control of each LCS system or the manual control of the LCS by the operator.
2. In manual control of the Mainline LCS by an operator, it can be set for all vehicles to enter the weight station or to bypass.
3. In manual control of the Ramp LCS by an operator, it can be set for all vehicles to come the static scale or the bypass lane.
4. Real-Time monitoring of the station operation by showing indicators when the appropriate sensors are activated and deactivated including loops
5. Graphics representing the color and status of the directional signals. The graphics will continuously display the status of the mainline message signs, overhead signals, open/closed signs, static scale message sign, and bypass lane message sign.
6. Select automatic sort control of the bypass and static scale lane VMS's or manual control by the operator.
7. Manual selection of the bypass and static scale lane VMS messages.
8. The Station system must provide an audible voice warning for the following conditions:
 - a. WIM scale backup
 - b. Weigh station violator
 - c. Violator in the bypass lane
 - d. Station automatically closing because ramp is backed up
 - e. Station is automatically reopening because ramp has cleared
 - f. Vehicle waiting on the static scale
9. Include a 22-inch flat panel monitor with speakers and shall interface with the weigh station computer. This monitor shall be one of the two monitors located at the weigh station compute.
10. Provide a graphical representation of the weigh station layout with symbols to indicate the function of vehicle tracking devices.
11. Allow for a true manual control of all signs.
12. Shall be similar to the image below:



5.3.4 Manual Override Console

A Manual Override Console shall be provided as an interface that allows the operator to override the Mainline and Ramp WIM Systems in order to gain control of various system components. The console will include control of the Open/Closed signs. The console will also include the ability to control the static scale message sign and turn the scoreboards on/off.

The override console will provide the ability for the operator to manually override all signals and signs. It will be a minimum of 24" long and 10" wide with large push buttons and switches to allow officers to quickly locate and change signal controls when override is required. The Override Console must be operationally independent of the weigh-in-motion interface electronics, the Virtual Graphics Panel, and the Station Computer to control all signs and signals. The override console shall remain operational even if the Station computer is not functioning with the exception of the Variable Message Signs.



5.4 Station Computer

The Station Computer shall:

1. Be an Intel microprocessor based computer with the Microsoft Windows 8.1 or 10 operating system.
2. Have the following minimum features and configuration:
 - a. Most current pc standards for memory, hard drive, and other hardware
 - b. Two 22-inch flat screen color monitors with non-glare screen
 - c. Keyboard
 - d. Mouse
 - e. System utilities and diagnostic software
 - f. Surge protection
 - g. System password protected lock for user access restriction
 - h. All access ports, cables and accessories to provide a working computer.

The Station Computer shall provide the following functions:

1. Perform mainline and ramp WIM operation.
2. Weigh all vehicles travelling in the right lane.
3. Classify all vehicles travelling on all instrumented lanes of the highway with piezo sensors.
4. Perform weight compliance analysis on vehicles in accordance with Wisconsin DOT regulations.
5. Monitor safety conditions of the facility these include:
 - a. A WIM scale back up
 - b. Ramp back up
 - c. Static scale lane back up
6. Perform sorter operation in accordance with decisions based on weight compliance analysis, other violations (speeding, improper maneuver, sudden speed change, etc.), Virtual Graphics panel Override console selection, safety conditions, and operator selected action.
7. Insert sequence numbers for vehicle records for tracking purposes.
8. Display of vehicle record in multiple queue windows

9. Track vehicle movement in the execution of sorter operation.
10. Control message display of the CMS/LCS of the LCS to synchronize with the movement of a vehicle being tracked.
11. Provide vehicle records for those that have been sorted to or come to the static scale.
12. Automatically position each vehicle on the static scale using the static scale VMS sign.
13. Provide real time display and control of the static scale.
14. Allow operators to automatically sequence vehicles across the static scale or manually weigh by accumulating axles.
15. Automatically determine and provide operators feedback based on whether a vehicle is actually overweight based on axle spacings, axle, axle group, gross, and front/rear bridge weights based on Wisconsin regulations.
16. Automatically or manually release vehicles that are not overweight based on Wisconsin regulations and do not have other violations.
17. Allow operators to print weight tickets.
18. Provide voice message alarms to alert operators of conditions that may require their attention.
19. Provide reports on system operation.
20. Perform data collection, data storage, file management and report generation functions for collected vehicle information.
21. Allow adjustment of WIM and system settings.

The Weigh Station system shall have application programs to detect prolonged power failure conditions to initiate orderly shutdown operation.

5.5 Scale Manager

The Scale Manager will be software located on the central Weigh Station Computer, and facilitate processing vehicles that are sorted or volunteer to come to the static scale. As officers primarily focus on vehicles that are potential violators this will be the main screen that they work with. The screen will also give the operator the ability to control system settings and view and run reports. It shall provide the following functions:

1. Interface with the static scale indicator and WIM systems.
2. Display and accumulate static scale weights and display WIM data for the vehicle that is positioned on the static scale.
3. Provide adjustable thresholds to each steer axle, axle, tandem, front bridge, rear bridge and gross weight based on Wisconsin regulations for axle spacing and weight.
4. Automatically check weights to thresholds and release vehicle if in auto mode or alert operator of violation with audio and visual alerts.
5. Automatically or manually allow operators to control the static scale sign with buttons matching messages defined in section 4.2.6.
6. Provide the following features within the display:
 - a. Selectable auto release
 - b. Display shift counts
 - c. Violations displayed in red
 - d. Zero scale
 - e. Reset scale

7. Print requirements include:
 - a. Site identification
 - b. License plate
 - c. USDOT number
 - d. Individual weights (axles and axle groups)
 - e. Gross weight
 - f. Time and date
 - g. WIM axle spacing
 - h. Thumbnail image of vehicle
8. Will continuously show updated static scale counts for each shift for the day.
9. Utilities
 - a. View individual live raw counts for static scale load cells
 - b. Allow remote diagnostics access

If a vehicle is not positioned properly or is a weight violator the operator shall be notified by visual and audio alarms and the vehicle will not be auto-released when in auto-sequencing mode.

To eliminate costly ramp calibrations, the Weigh Station System shall electronically interface with the Mainline WIM system for auto-calibration. On a continuous basis the Weigh Station System shall ensure WIM accuracy and calibration.

Calibration of the mainline WIM shall be automatic and performed by electronic recording of WIM and static weights on 50 vehicles from the vehicle stream which are loaded to within 75% of the legal allowable limit. Auto-calibration will be done with different factors for speed range and vehicle class to provide more accurate results. The settings shall allow for a minimum of 10 different speed ranges and 13 different classes to be used.

Acceptance testing shall confirm the WIM accuracy performance which shall be verified in a report. This report shall be created by continuous (24/7) electronic recording of vehicles from the vehicle stream. The actual stable static weights and WIM weights shall be saved in a common database to determine WIM scale accuracy compliance, as opposed to the method described in ASTM E1318. This information is to be easily accessible to state personnel in reports and shall be printed on a weekly basis throughout the continuous operating test and in everyday use of the weigh station afterwards.

The accuracy requirements required under the WIM scale section above exceeding ASTM E1318 for a Type III WIM shall be met.

All reports will be available from the Scale Manager for one central place to view reports. The following reports shall be available:

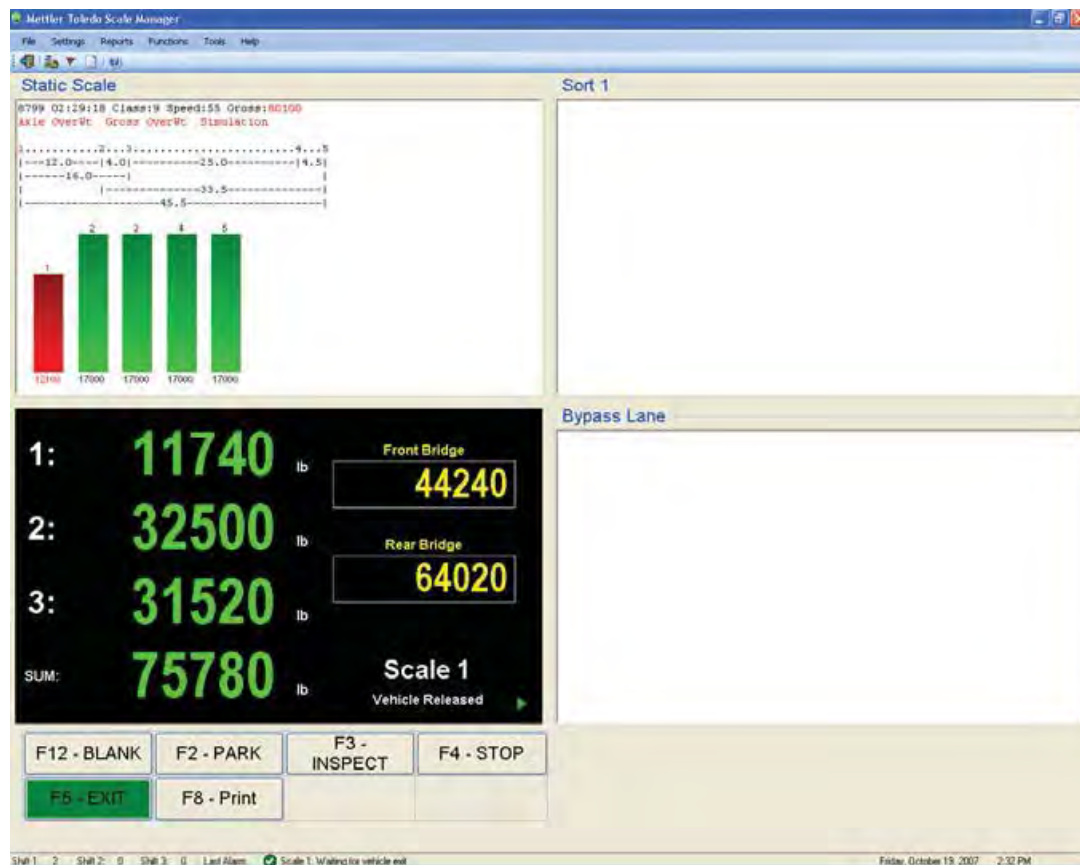
1. Number of vehicles per lane across the WIM by class, hour, and shift for a selected period.
2. Number of trucks per lane across the WIM by hour, and shift for a selected period.
3. Number of trucks per lane across the WIM by hour, and shift for a selected period
4. Axle and GVW weights by class for a selected period.

5. Number of vehicles per lane by weights, by class and by hour for a selected period.
6. Number of vehicles across the static scale by class, hour, and shift for a selected period.
7. WIM accuracy performance by class for a selected period.

A selected period for report generation shall include starting date and ending date. Reports shall be generated manually by operator action. Reports shall have an option to display a chart view, and to be exported into Microsoft Office compatible formats.

The Static Scale Manager shall have utility programs do the following:

1. Set up and configure the operation of the Ramp WIM systems.
2. Set up and configure the operation of the Ramp Sorter Systems.
3. Initiate and reset traffic counting operation of the WIM Systems.
4. Perform maintenance functions of the Weigh Station systems.



6 Virtual Weigh Station WIM System Functional Requirements

6.1 WIM Scales

The accuracy of the Virtual Weigh Station WIM system shall be in conformance with the current ASTM E1318 "Standard Specifications for Highway Weigh-in-Motion (WIM) Systems performance requirements for a Type III system.

Place 11-inch concrete pavement in both driving lanes. The concrete pavement shall cover the width of the roadway with doveled, 14.25-foot joint spacing as shown in the plans.

The concrete pavement shall begin 200 feet prior to the proposed scale location and shall end 100 feet after, for a total 300 feet of concrete roadway. Concrete pavement shall be paved through, then an area sawcut and removed to enable WIM scale installation.

Blanket grind the new concrete pavement in the eastbound drive lane beginning 200 feet prior to the WIM scale location and ending 100 feet after the scale location, for a total of 300 feet, with a minimum 36 inch blanket grinder to ensure that the roadway meets the requirements of Section 6 of ASTM E1318 prior to installation of the WIM system.

The WIM scales will use load cells meeting the requirements below. WIM scales that are bending plate or a load cell weigh pad are not acceptable. The WIM scales shall measure approximately 144-inch x 38- inch including frame.

Each scale module shall be a self-contained weighing unit. Each scale module shall measure approximately 72-inch x 38-inch including frame. Each scale will have a weighing capacity of 50,000 lbs (single axle). Each has a static weighing accuracy of 1% or better as demonstrated by applying certified test weights in three places on each platform – each side and center.

There shall be two scale frames into which the two scale modules are mounted. Install the WIM scale flush with the road surface.

The WIM scales shall operate properly in a temperature range of -40°F to +160°F. The WIM scales and their frames shall be hot dip galvanized for protection according to ASTM A123. All installation hardware shall be either stainless steel or hot dip galvanized. All surface mounting bolt and service holes shall be sealed.

The WIM scale shall be weather-sealed. Any water, ice, snow, salt, debris, dirt, moisture, or sand will not degrade scale performance.

The design of the WIM scales is to be such to provide a fatigue life of 20 years based on weighing 10,000 trucks per day with 40,000 pound dual tandem axles.

Ground the WIM scales and frames as per manufacturer's recommendations. Protect the signal processing and electronics/modules against lightning.

Replacement of any load cell shall be accomplished within one hour after replacement of a load cell. The WIM scale shall not require calibration after replacement of a load cell.

6.2 WIM Load Cells

The WIM load cells shall strictly meet the following requirements:

1. Constructed of 17-4 stainless steel construction
2. Hermetically sealed NEMA 6P IP 67 rated
3. Have temperature compensation inherent to the load cell design
4. Span temperature coefficient of 100 PPM/degrees Celsius
5. Zero temperature coefficient of 300 PPM/degrees Celsius

6. Loading and unloading time not to exceed 60 seconds each
7. Provide lightning and surge protection
8. The load cell cables for the WIM scales shall be stainless steel braided cable to prevent damage by rodents.

6.3 Axle Sensors

The Virtual WIM system may use axle sensors in each lane for WIM or classification operation. The axle sensors shall be Class I piezoelectric and approximately 12 feet in length.

Install the axle sensors below the road surface. The axle sensors and their electrical wiring connector shall be completely water tight and sealed.

6.4 Loop Detectors

Each detector loop shall have a minimum loop area of 6-ft x 6-ft. Loops shall be installed beneath the new concrete pavement. Detector loops shall conform to WisDOT standard specifications.

Loop wire shall be 1 conductor, 14 AWG, IMSA 51-5. Loop leads shall be 2 conductor, 14 gauge, IMSA 50-2 cable.

6.5 WIM Electronics

Locate the System Electronics near the WIM scales in a protective roadside cabinet. The System Electronics shall be responsible for creating truck data and formatting the truck data for a web server to enable an enforcement officer to remotely view the vehicle records via wireless Ethernet. The WIM interface and data collection computer shall be a stand-alone system with the capability to collect and interpret the signals from the WIM Scale.

The virtual WIM system electronics shall contain the interface and signal conditioning for the inroad sensors and camera, a process computer, and an integral power supply. Provide all material necessary for setup and operation of the system, including all coeds and cabling. Provide the system with the required software pre-loaded so that it will automatically execute when the system is powered up.

The electronics shall be modular in design to facilitate easy maintenance, troubleshooting and in-field servicing. The computer, power supply and the interface electronics shall meet the following requirements.

The electronics shall include interfaces to the following components:

1. WIM Scales
2. Axle Sensing
3. Loops
4. Off-scale Detection.
5. Camera System
6. Communications System

The roadside electronics shall provide a facility for viewing vehicle records and sensor diagnostics directly without any ancillary equipment.

All components of the electronic system, including inductive loop detectors, shall contain electrical protection to prevent damage from electrical surges, spikes and lightning.

The system shall be of a durable, industrial design and construction, and enable continuous operation, with automated start-up in the event of a power outage.

The System Electronics shall provide the following functions:

1. Perform WIM operation.
2. Weigh all vehicles traveling over WIM scales.
3. Classify all vehicles traveling on all instrumented lanes of the highway.
4. Perform weight compliance analysis on vehicles in accordance with department or agency regulations.
5. Perform sorter operation in accordance to decisions based on weight compliance analysis, other violations (speeding, improper maneuver, sudden speed change, etc.).
6. Insert sequence numbers for vehicle records for tracking purposes.
7. Capture images for all commercial vehicles.
8. Filter out all non-interesting images and format for Web server.
9. Perform data collection, data storage, file management and report generation functions for collected vehicle information.

The system shall include a data extraction system to allow data to be retrieved in the field.

Provide a virtual weigh station with a roadside cabinet to house the System Electronics, the WIM computer and its peripherals and the overview camera equipment.

The roadside cabinet shall be weatherproof aluminum, lined and insulated and installed with a fan and heater. All cutouts and openings shall be vermin proofed.

Terminate all wires from scales, off-scale sensors, axle sensors, loops, cameras, on terminal strips or screw terminal connectors. The terminal strips shall be identified by terminal strip number and screw connection number. These terminal strips shall be readily accessible. All cables shall be long enough to easily reach these terminal strips. Terminal strips, splices, or other type of connections prior to these standard terminal strips shall not be allowed except for splicing of a loop to a shielded twisted loop lead.

Shield all AC power connections to prevent electrical shock.

The components of the system shall provide heartbeat communications so the Systems health can be monitored

6.6 WIM Scale Autocalibration

To minimize or eliminate costly calibrations and maintenance, the WIM scales shall allow feedback to be provided from certified scales. The system shall store both WIM gross weight and manually entered static weights which shall be used for WIM scale auto-calibration. On a continuous basis the Virtual WIM system shall ensure WIM accuracy and calibration.

Calibration adjustment of the each WIM Scale shall be automatic and performed by electronic recording of WIM and static weights entered by officers which are loaded to within 75% of the legal allowable limit. Auto-calibration shall incorporate speed range and vehicle class to provide more accurate results.

6.7 Camera System

The Camera System shall consist of the following system components:

1. Color and Black/White video camera
2. Illuminator system
3. Video capture system

The overview image system shall monitor traffic flow on the roadway at the Virtual WIM site. It shall capture still images of trucks having violations for identification and enforcement purposes. The images shall be displayed on an operator interface located in the Sparta SWEF. Each vehicle record number shall be displayed with the vehicle image.

Provide and install one camera for the WIM System on a pole located near the virtual weigh station location. The camera shall provide overview images of both lanes for passing commercial vehicles, detailing their cab and side. Color images shall be provided for daylight use, and black/white images shall be provided for night use. The camera images shall be crisp and clear 24 hours a day and in all lighting conditions.

The camera poles and bases shall conform to the requirements of standard spec 657 and standard spec 672.

The components of the system shall provide heartbeat communications so the Systems health can be monitored.

6.8 Communications

Data from the virtual weigh station system shall be communicated to the Sparta SWEF via high speed Internet connection. The system shall allow the operator to connect remotely to access the vehicle data.

6.9 Portable Static Wheel Load Scales

Furnish two sets of six scale units meeting the following specifications. The units shall be portable hydraulic/analog (mechanical) designed to weigh commercial vehicles. The unit shall be applicable for use in law enforcement as a wheel-load weigher for weighing commercial vehicles which includes large trucks and buses.

Each unit shall have a large active platform measuring a minimum of 26-inches x 15-inches to accommodate the space needs of dual and large tires. The height shall not exceed 3/4-inch in order to negate the need of ingress and egress ramp. The total physical weight of the unit shall not exceed 35 pounds. Each unit shall be completely waterproof and dustproof.

Each unit shall be able to accurately weigh up to 20,000 pounds, with:

1. A rate of “+ or –“ 50 pounds up to 2,500 pounds.
2. A rate of “+ or –“ 100 pounds between 2,500 and 10,000 pounds.
3. A rate of “+ or –“ 300 pounds between 10,000 and 20,000 pounds.

The weight gradations shall be easily readable and must be in 50 pound or less increments. The readout system shall be capable of indicating weights from 0 to 20,000 pounds. The unit must have incorporated a simple zero adjust method to facilitate zeroing before each weighing.

Each unit shall remain within the acceptance tolerance when subjected to temperatures of 0 degrees or less to 120 degrees or more. Each unit shall be able to weigh accurately under conditions not absolutely level. Each unit shall be capable of 24 hours of continual use without need for battery recharge of external power source.

Each unit shall meet applicable technical requirements of National Institute of Standards and Technology (NIST) Handbook 44 as they pertain to specifications, tolerances, and other technical requirements for wheel load scales or Class III devices. The NIST Handbook can be obtained at ts.nist.gov/weightsandmeasures/h44-07.cfm.

Each unit shall be capable of being calibrated with the portable manual test stand described below. All weighing and measuring devices are required by State law to have a NTEP Certificate. Any piece of equipment purchased for the purposes of calibrating/testing wheel load scales must have a NTEP certificate of conformance.

6.10 Portable Manual Test Stand For Portable Scale Calibration

Furnish one unit meeting the following specifications. The unit shall be portable, capable of testing and calibrating portable static wheel load scales. The unit shall have an accuracy of 0.10% calibrated to ASTM specification E-74 with capacity 20,000 lbs. x 1 lb. graduations. The range shall be zero to full capacity with travel of 8-inches.

The unit shall be aluminum, 6000 Series. The unit shall have a minimum 33-inch x 21-inch test surface area. The overall unit weight shall be less than 300 lbs. with carrying/lifting handles.

The unit load cell shall be steel with a capacity of 25,000 lbs. The accuracy shall have nonlinearity, hysteresis and nonrepeatability @ $\pm 0.05\%$ R.O.

The unit hydraulic system pump shall be 2-speed manual hand operation, 10,000 psi. The cylinder shall have a 30-ton single action capability and a 10,000 psi pressure gauge.

The indicator resolution shall have 10,000 displayed graduations and 1,000,000 internal graduations. The NIST Classification shall meet or exceed HB-44 class III/IIIL at 10,000 divisions. It shall be battery operated using rechargeable NiCad batteries, 12-120 VDC/VAC. The display shall be LCD, 6-digits.

The aluminum loading block shall have a minimum size of 10-inch (± 0.25 -inch) x 17-inch (± 0.25 -inch) x 1.75-inch. The rubber loading pad shall have a minimum size of 10-inch (± 0.25 -inch) x 17-inch (± 0.25 -inch) x 0.5-inch (± 0.125 -inch) with 40 to 70 Shore A rating

7 Conduit and Pull Boxes

All cables shall be in conduit unless specifically approved by the engineer. All conduit and pull boxes shall conform to the requirements of Chapters 652 and 653 of the standard specifications.

All materials shall comply with the "National Electrical Code" and the current standard specifications, "Highway Division Standard Drawings for design and Construction", and special requirements by State weigh in motion and automatic vehicle identification system specifications. Duct seal shall be used to seal all conduits in the cabinets and in all junction boxes. All conduits shall have a polyethylene pull string with at least 210-pound break strength left in place at completion of construction.

Separate conduits shall be used for AC/DC power and low voltage signal cables. Low voltage signal cables shall include video, digital communication, sensor signal cable, and sensor excitation cables where voltage is under ± 20 volts DC. Conduits for video and RF cables shall be of a large enough size to accommodate the maximum bend radius using factory 90-degree "bends".

All cables shall be in conduits unless specifically approved by the department.

8 System Acceptance

The Mainline, Ramp and Virtual WIM Systems shall be accepted subject to fulfilling the following conditions:

1. System review
2. Acceptance tests (meeting WIM, LPR and AUR accuracy on a weekly basis).
3. Training

8.1 System Review

The potential WIM Vendor shall submit six copies of a system layout and cut sheets for each individual site prior to award of their subcontract. These layouts shall be submitted to the Department for review. Approval shall be either an official from the Department or designated representative. If the potential WIM Vendor does not fully meet the specifications the Department may instruct the prime contractor to select another vendor.

A preliminary on-site meeting shall be held for each site to discuss contractors' plans for the routing of conduits, cables, and placement of equipment.

8.2 Acceptance Tests

The Mainline, Ramp and Virtual WIM Systems, all-inclusive as contracted, shall be designed, built and tested by the Vendor, and as proof of operation, the systems, overall and singularly, shall be tested at various times according to the test specifications. All field tests shall be performed by the WIM Vendor and observed by the State with all reports submitted to the State.

8.2.1 Factory Acceptance Tests

Prior to shipment of any equipment, Factory Acceptance Tests shall be performed for each system to verify the equipment operating as described in the contract documents and in accordance with the test specifications approved by the State. The Factory Acceptance Tests shall include at minimum the following:

1. A physical inspection to verify that the quality of material and workmanship satisfy specified requirements and standards and that the equipment and software under test are complete and ready for delivery.
2. A functional test to verify that the equipment and software operate as described in the contract documents.
3. A performance test to verify that the equipment satisfies performance and operation criteria.

For the purpose of these tests the equipment and software shall be configured as nearly as possible to the final configuration. Any field inputs not available at the factory test site shall be simulated to provide a close approximation to actual site conditions.

8.2.2 Site Acceptance Test

After all the equipment and software have been installed at the site, the vendor shall run tests to ensure that all equipment shall operate as specified therein contract documents. These tests shall be witnessed or conducted by the department within one week of the manufacturer notifying the department that the system is ready for testing.

The camera systems shall be tested at the sites to verify that the images taken at daytime and night time are clear and integrated properly with the vehicle record from the systems. The Vendor shall collect data observed by the department and provide the results of the images taken for the duration of the testing during day and night time operation. Success will be determined by images that are non-blurred, crisp, properly integrated, and correctly read with the vehicle data received by the systems.

8.2.3 Continuous Operating Test (COT)

Following successful completion of the Site Acceptance Test, a Continuous Operating Test shall be conducted for a period of 56 calendar days.

System manufacturer shall perform the in-motion calibration tests of WIM subsystem after installation is completed and prior to beginning the burn-in period. Contractor shall provide the Engineer one week's notice of the in-motion calibration tests.

1. SYSTEM manufacturer shall provide calibration weights.
2. COT period begins two weeks after the completion of installation and certification of Static scale.
3. COT cannot begin until the static scales have been certified.
4. Contractor shall submit a detailed test plan to the Department for approval no later than 90 days after notice to proceed.
5. For the COT period, the SYSTEM shall be fully operational under normal traffic conditions and operate trouble free (defined as any error that will not reset by means of rebooting PC) for 24 hours each day for 7 days of each week for 56 consecutive days.
6. Only one reboot per shift shall be allowed.
7. The engineer shall check the accuracy performance by printing an accuracy report from an electronic database which is created and stored on the static scale computer.
8. The report for WIM accuracy must be printed from the static scale computer by the Engineer and met weekly during the APT period.
9. WIM accuracy on all vehicles loaded above 60,000 pounds and traveling between the speeds of 5 to 85 miles per hour shall be as follows:
 - a. Axle weights + 12% (95% of trucks)
 - b. Tandem weights + 8% (95% of trucks)
 - c. Gross weights + 4% (95% of trucks)
 - d. Axle spacing + 6 inches (68% of axles), whichever is greater

This database shall be created by continuous electronic recording of vehicles from the vehicle stream, which are loaded to within 75% (60,000 lbs.) of the legal allowable limit.

The actual stable static weights and WIM weights shall be stored in this common database to determine WIM scale accuracy compliance, as opposed to the method described in ASTM E1318.

The images and OCR reads from the LPR and DOT reader shall be captured over a week and a report generated showing how each image was read and total read rate percentages for readable plates including jurisdiction and numbers. The images will be provided for department verification. The read rates must exceed meet or exceed these specifications

The SYSTEM manufacturer must leave the site prior to the start of the COT and may only return if a problem is encountered or accompanied by the engineer.

If problems of any kind are encountered during the COT, the SYSTEM manufacturer will be informed and problem(s) shall be simultaneously witnessed by the engineer and contractor. If problem is confirmed by all, a strike will be assessed and problem shall be corrected.

After confirmation from SYSTEM manufacturer that problems are solved and at the discretion of the engineer, the 56-day COT will start over until 56 continuous days of trouble free operation are experienced. This re-start can only occur three times.

The COT shall demonstrate to the satisfaction of the engineer that the weigh-in-motion/static enforcement system has been constructed and consistently meet the performance requirements of the plans and of this Technical Special Provision.

The continuous operating test will be the basis for acceptance or rejection of the systems (mainline, ramp and virtual) as a result of demonstrated performance. If the system is rejected and there have been more than three strikes and re-starts of the COT, the parties will negotiate, in good faith, an acceptable resolution. Following such negotiations, if the same are unsuccessful, the department may execute the performance bond. Notwithstanding the foregoing, the contractor will retain/be entitled to receive all amounts paid or payable to the contractor in accordance with the following payment schedule, agreed-to by the parties:

PAYMENT

1. Payment upon safe and secure delivery of all equipment at a storage location approved by the engineer	20%
2. Complete installation of the entire SYSTEM	40%
3. Completion of calibration and burn-in	10%
4. Completion of the COT to the satisfaction of the engineer	30%

The department will issue a Certificate of Final Acceptance upon successful completion of the Continuous Operating Test and training program.

The WIM acceptance procedure for the weigh station system will be based off of officers printing the database comparison of mainline WIM and static scale weights and the WIM accuracy meeting project specifications.

The WIM acceptance for the Virtual WIM system will be based off of a report detailing the comparison of the WIM and the portable scale weights entered by officers and the WIM accuracy meeting project specifications.

9 Training

The Vendor shall set up and conduct formal training programs for the State Patrol personnel on the operation, maintenance and installation of the system components of the Mainline, Ramp and Virtual WIM Systems. The training shall include the following:

1. Two half-day operator training sessions providing an introduction to the operation and installation of the Mainline, Ramp and Virtual WIM Systems, and to the functions performed by the major system components. A class size of up to eight individuals per session can be expected.
2. Two one-day "hands-on" guidance sessions for operators in the operation of the systems. A class size of up to four individuals per session can be expected. This training will occur during the first two days of the Continuous Operating Test.

The training program shall be scheduled the week following the completion of the operations test.

The cost for the first training sessions shall be included in the contract price. Wisconsin DOT will, from time to time review any future training requirements. The WIM Vendor will agree to provide future and additional training sessions upon receipt of requests from Wisconsin DOT. Wisconsin DOT will reimburse the WIM Vendor the cost of providing additional training sessions on a per diem basis and at a rate agreed upon by Wisconsin DOT at the time of the request. Wisconsin DOT will provide classroom space for training session.

The vendor shall provide six hard copies and an electronic file of the WIM System Operator's Manual. The manual shall contain detailed information and instructions covering all aspects of the WIM System.

10 Warranty

The WIM vendor shall warrant all subsystems and system components as supplied and installed for five years from the date of issuance of the Certificate of Final Acceptance of the Mainline, Ramp and Virtual WIM Systems by the engineer. This warranty and associated maintenance work are defined and covered under a separate bid item, Weigh-In-Motion System Warranty Maintenance.

The portable static wheel load scales shall each have a minimum 3-year warranty, to include parts, labor, shipping, updates, modifications and recalls.

The Portable Manual Test Stand for Portable Scale Calibration shall have a minimum 3-year warranty, to include parts, labor, shipping, updates, modifications and recalls.

11 Materials

Materials used in the construction of this equipment shall be of good commercial quality entirely suitable for the intended purpose. Materials shall be free from all defects and imperfections that might affect serviceability of the finished product.

12 Standard Products

The equipment shall be constructed of standard material, so that the prompt and continuing service and delivery of spare parts may be assured. The component parts need not be products of the same manufacturer.

13 Lightning Protection

Ground rod(s) and lightning protection shall be provided as per manufacturer's requirements. All system components and equipment shall be properly grounded.

14 Measurement

The department will measure Weigh-In-Motion System, completed and accepted in accordance with the terms of the contract, as a single complete lump sum unit of work.

15 Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.200	Weigh-In-Motion System	LS

Payment is full compensation for furnishing and installing all materials; coordinating and making all utility hook-ups; performing all pavement grinding; and for furnishing all labor, supervision, equipment, calibrating and testing, training, tools and incidentals necessary to complete the contracted work. Materials and equipment included in the Weigh-In-Motion System are mainline WIMs, ramp WIMs, concrete control pad, Load Cell Scales, Piezoelectric Sensor, cameras, System Electronics (including all interface cards), WIM cabinets, Uninterrupted Power Supply, Modem, Override Console, printer, cabling, conduit, junction boxes, software, software licenses, Portable Static Wheel Load Scales, Portable Manual Test Stand, Lane Control Signals, "Open/Closed" CMS inserts and VMS and CMS Signs and supports.

Associated Sawing Asphalt, Sawing Concrete, Removing Pavement, Drilled Dowel Bars, Drilled Tie Bars, Base Aggregate Dense 1 1/4 Inch, Concrete Pavement Repair, Concrete Pavement Replacement, Concrete Pavement 10 or 11-Inch and Signs, Type II will be paid under separate bid items.

50. Static Scale System, Item SPV.0105.201.

A General

Furnish and install one motor truck scale with dual tandem axel capacity of 70,000 lbs, a gross capacity of 100 tons and triple weighing platforms placed end to end in the same pit. Equipment to consist of parts designed to act as a unit by a manufacture experienced in design, construction, and operation of equipment for the purpose required.

The Static Scale System shall be tightly integrated with the Weigh Station System.

Data acquired from the Static Scale System described in this specification must be such that it may be readily associated with other data for the same vehicle into a record that coherently represents data acquired from weigh in motion, static scale, and overview camera system. The following specifications represent the minimum static scale requirements.

B System Components

B.1 The Static Scale

Furnish and install one motor truck scale with dual tandem axel capacity of 70,000 lbs, a gross capacity of 100 tons and weighing platforms of 42'11" x 12' wide, 22'11" x 12' wide and 15'3" x 12' wide placed end to end in the same pit. Equipment to consist of parts designed to act as a unit by a manufacture experienced in design, construction, and operation of equipment for the purpose required.

1. The static scale shall have seven sections (four weighbridge modules with factory-poured concrete).
 - a. The static scale platforms shall have reinforced concrete decks.
 - b. The concrete deck shall have a dual tandem axle capacity of 70,000 lbs on 4' centers.
 - c. Each of the platforms shall consist of a prefabricated factory-welded weighbridge assembly.
2. The weighbridges are of factory welded I-beam girder design and all steel surfaces of the weighbridge shall be hot-dip galvanized according to ASTM A123.
 - a. The weigh bridge main girders shall be ASTM A572 steel, minimum of W24 x 68 lbs.
 - b. The weigh bridge cross girders shall be ASTM A572 steel, minimum of W12 x 35 lbs.
 - c. All in-house welding on the structure shall be either gas to metal, submerged or shielded arc process. All welding procedures to be in compliance with the American Welding Society D1.1-88 Structural Welding Code.
 - d. All bolts will be hot-dip galvanized according to ASTM A153.
3. The deck surface shall be 10" thick concrete, having a minimum compressive strength of 4000 psi.
 - a. The deck shall be lined along the bottom with 3/16 STM-A36 steel plate or galvanized deck sheeting, a double reinforcing mat shall be set into place the length and width of the scale deck, and the deck channel to have studs welded to the steel to form a composite structure when the concrete is added. The reinforcing mat and deck channel studs are to relieve surface tension in the concrete caused by expansion and contraction.
 - b. The color admixture shall be reddish-brown (Federal Standard Color No. 31136) or similar color approved by the engineer. Add colored admixture to the mix per manufacturer's written instructions in a pre-measured bag and not added by weight of cement content. Admixture shall be a colored, water-reducing, admixture containing no calcium chloride with coloring agents that are lime proof and UV resistant.
4. The scale shall be completely self-checking. No check rods shall be used. The scale shall not use the load cell as a checking devise.
5. No manholes are allowed in the scale deck. Scale pit access will be from an outside pit entrance. 8-inch diameter access holes with a secured cover shall be provided in each scale deck. Scale pit access will be from an outside pit tunnel entrance.
6. Provision may be made for lifting the platform and weighbridge by casting 3-inch sleeves through the concrete deck. If used, sleeves shall be Type 304 stainless steel.
7. The scale platform and scale pit wall surfaces shall be treated with a protective surface treatment conforming to standard spec 502.

B.2 Load Cells

Load cells shall provide the following:

1. The weighing elements shall be stainless steel hermetically sealed load cells to guard against moisture ingress and barometric effects.
2. The cells shall have moisture protection to IP 68 standards.
3. Load shall be applied to the cells without the use of links, bolts, pins cables or flexure.
4. All load cells shall be self-centering.
5. Load cells shall provide a digital signal output.
6. The load cells shall not require junction boxes and shall be connected in a simple network to prevent from costly service calls.
7. The load cells shall be a minimum of 50 tons capacity each, and each cell must have stainless steel braided covering on the load cell cable.
8. All load cells must be manufactured of stainless steel.
9. The scale shall have self-diagnostic capabilities able to identify load cell problems and failure.
10. The scale shall be able to identify each load cell individually.
11. The scale shall have the ability to view all of the load cells in the scale system simultaneously.
12. Diagnostics to have the capability to predict the failure of a cell before it actually happens to prevent down time. The diagnostics are to measure load cell counts (not weight) to determine reliability of the load cells. The following diagnostics shall be available at a minimum:
 - a. Individual cell not responding
 - b. Individual cell negative out of range
 - c. Individual cell command failed
 - d. Individual cell enclosure breach
 - e. Power up Zero
 - f. Major and minor overvoltage or overcurrent
 - g. Major and minor under voltage
 - h. Individual cell not found
 - i. All errors shall be logged in the static scale electronics with the capability to be emailed when an error occurs
13. The design shall permit the individual load cells to be matched and the scale sections to be electronically calibrated.
14. Load cell shall have been tested and passed lightning simulated, lightning strike up to 80,000 amperes. Documentation to be provided with submittals.

B.3 Technical Specifications

Maximum Capacity (tons)	100 tons
Dual Tandem Axle Capacity (lbs.)	70,000 lbs
(Concentrated Load Capacity (CLC) is not the same as dual tandem axle capacity)	
Overall Scale Dimension	
(L x W) (Pit opening, in feet)	81'-4" x 12'-1 1/4"
Deck Material	Concrete (Colored)

Scale Accuracy	0.1%
Weighbridge:	
Weighbridge Design	I-Beam
Number of Sections	7
Number of Modules	4
Reinforcing Steel Size	Double welded mats minimum W16 x16 on 4"x4" centers
Number of Manholes	0
Number of 8" access holes	4
Type of Checking	Bumper
Deck Concrete	Yes
Pit Coping included (Y/N)	Yes
Deck Channel included (Y/N)	Yes
Load cells:	
Load Cell Type	Rocker Column
Rated Capacity	50t (100,000 lbs)
Safe Overload	200 %
Ultimate Overload	300 %
Safe Sideload	100%
Material	Stainless Steel
Load Cell Cable	4 conductor 22 AWG Shielded
Load Cell Cable Protection	Stainless Steel Outer Jacket
IP Rating	IP 68
Rated Excitation	5 to 15 Volts
Temperature Compensation Range	-10 to +40 o C
Standard Instrument:	
Resolution	10,000 d commercial 50,000 d non- commercial
Display Size	16 lines @ 26 characters/line
Display Rate	0.1 to 10 sec. by 0.1 steps
Over Capacity Warning (Y/N)	Yes
Units Switching	Programmable
Zero Range	Programmable 2% or 100%
Motion Band	Programmable XXX
Dimensions (desktop model)	14.85" x 12.00" x 3.72"
Mounting	Desk
Load Power Supply Limits	8-350 ohm cells, 16 - 1000 ohm
Loadcell Input	Analog

Instrument Environmental Specifications:

Operating Temperature	-10 to 40 C o
Operating Humidity	Non-condensing
Storage Temperature	-20 to 60 C o

Instrument Power

Requirements:

Power	17 VAC +/- 10 % 230 VAC +/- 10%, 50-60 112 +/- 2 Hz
Grounding	RG 3.0 Ohms to Earth Ground (Resistance to ground)

Ticket Printer Specifications:

Type of Printer	Network

Electrical Requirements:

Volts	1 17 / 230 VAC selectable
Full Load Amperes	10 A
Isolation Transformer Voltage KVA Ratings	1 KV
Conduit Size	Up to 50

B.4 General Pit Construction

This section describes pit construction and weighbridge installation techniques. These instructions are a brief overview and supplemental to the plans and technical manuals that will be provided should the order of a scale be placed. Listed below is a guideline for installation.

B.4.1 PIT CONSTRUCTION NOTES

1. All concrete shall be Grade A. All concrete work shall be performed in accordance with section 501 of the Standard Specifications. All concrete is to be a minimum of 3500 post. @ 28 days.
2. Reinforcing bars shall be equal ASTM A615, grade 40 or 60. Bend bars cold to conform with required details on drawings. Remove scaled, loose flaky rust, dirt, and other coating that would impair bonding. Spaces bars properly and tie securely in position before placing concrete. Tack welding to keep reinforcing in place is not permitted.
3. Suitable conduit for low-voltage conductor-shielded cable must pass through the pit wall at any point above the pier tops that is convenient. Conduit must extend beyond the pit wall a minimum of 2".

For conduit runs up to 50' in length, use 3/4,' conduit. Avoid running conduit next to high voltage lines. Provide #10 copper ground lead at instrument location. Connect to 10' copper-clad round rod driven in moist earth. If AC is required in the pit, it shall not run more than 24' in parallel to any cell cable.

4. Inside and center lines of dimensions must be maintained.
5. Pit walls and footing depths as indicated on plans are the minimum recommended where normal soil conditions prevail.
6. All scales require ground rods through the floor of the scale to the specified depth.
7. Angle iron and coping are to be attached to the top wall form at the elevation as shown on the plan.
8. Bumper plates to be placed in their proper location on the inside of the form so they will be flush with the face of the wall. Bolt heads are to be in the wall projecting as indicated in the drawing.
9. Excavation, foundation forms, rebar, and concrete shall be furnished by the contractor.
10. 2000 P.S.F. minimum soil bearing capacity is required. The design is adequate for a highway surcharge of 300 P.S.F. adjacent pit walls.
11. Work from center lines when erecting forms and placing foundation bolts.
12. Concrete platform slabs may be factory-poured or field-poured concrete.
13. It is recommended that the weighbridge be assembled and blocked in the pit before load cells are installed.

B.5 Static Scale Electronics

Furnish and install one electronic instrument to drive the above specified scale. 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 scale instrument and all peripheral devices should be designed to function as a unit. The equipment shall have the following specifications:

B.5.1 HARDWARE SPECIFICATIONS

Static scale hardware shall include:

1. Static scale indicator
2. Microprocessor based item(s) for
 - a. Scale read out
 - b. Control and data handling functions
3. The scale instrumentation shall be compact and approved by the Engineer.

4. Manufacturer shall provide proof that the instruments have been in use successfully for at least two years.
5. Provide microprocessor-based digital instrument with Ethernet weight output to the static scale PC and the monitor for totalizing and printer controls.
6. This connection shall provide diagnostics of static scale load cells (load cell raw counts) to the static scale PC or a remote PC.
7. Provide with software diagnostics to facilitate fault finding.
8. Provide a certificate of conformance from the NIST Handbook 44, latest adopted edition.
9. The static scale instruments shall include:
 - a. Must be able to power up to 4 scale platforms
 - b. All instrument setup functions and calibration sequences are programmable through the keyboard/display. No at-scale adjustments required for these functions.
 - c. Minimum of 15 updates per second
 - d. One display showing individual axle weights and the summation of the individual weights
 - e. Shall be suitable for desktop or set-in mounting, level or at angle
 - f. Display the raw counts of each individual load cell without disconnecting any of the load cells from the system
 - g. Perform all static scale instrument set-up functions via static scale internet explorer web pages. Download to instrument via Ethernet connection.
 - h. Selectable increments size from 20 to 50,000.
 - i. Display up to 1 part in 10,000
 - j. Internal resolution 1 part in 1,000,000
 - k. Setup functions stored in nonvolatile RAM memory
 - l. Adjustable digital filtering
 - m. Adjustable automatic zero maintenance
 - n. Serial ASCII output port configuration for connection to computer. Baud rate to be selectable from 300 to 9600
 - o. Motion detection should be selectable from ± 0.5 , ± 1.0 , ± 2.0 , ± 3.0 increments
 - p. Display verification test
 - q. Display height at .5 inches with wide angle view
 - r. Static scale instruments shall meet the current specifications of the NIST Handbook 44, current adopted edition
 - s. The instrument shall be UL/CSA listed
 - t. Provide one button printing of weight ticket or axle accumulation

B.6 STATIC SCALE OPERATION SPECIFICATIONS

1. Each load cell shall have a cable length of no more than 10 feet in stainless steel braided cable.
2. The scale instrument shall only receive digital information from the load cell assemblies. There shall be no analog to digital conversion function in the scale instrument or in junction boxes between the load cell and the scale instrument.

3. The scale instrument shall be capable of assigning each load cell with its own unique identification number and shall be capable of displaying the weight reading of each individual load cell through the instrument without disconnecting any of the load cells from the system.
4. The scale instrument shall communicate with each individual load cell.
5. The scale instrument shall be capable of being programmed and calibrated in pounds or kilograms.
6. The display is to be a full color 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.
7. The scale instrument shall communicate static scale weights to the Scale Manager on the central Weigh Station computer to display weights on the computer system screen, and to allow the accurate weighing of the truck on the static scale.
8. The scale instrument shall have program to accumulate up to 19 axle and axle groups and print 8.5 x 11 weight tickets that is independent of the WIM system. This program should work as a backup in case the Station system is not working.
9. The instrument is to have the capability to run multiple scales as a standard unit. Adding extra boards at a later date is to be considered not meeting specifications. The instrument is to have self-diagnostics built in that allow the technician to view all load cell outputs simultaneously.
10. Simultaneous viewing of load cell output allows for fast easy analysis of the scale operating system. Viewing cell outputs one at a time is not acceptable.
11. The system shall have the ability to be 100% calibrated from within the scale house. Corrections or calibration adjustments at the scale through summing boxes are not acceptable.
12. Summing boxes with potentiometers or junction boxes in general are not acceptable anywhere within the system.
13. Surge Voltage Protection on the system shall be optically isolated at each load cell, and transformer coupled from the instrument.
14. Scale is to have the ability to be analyzed via modem.
15. The scale instrument is to have the ability to be programmed via modem.

16. Modem diagnostics will allow simultaneous viewing of all load cells in counts, and actual weight that each individual load cell is sensing. Viewing of cells one at a time is not acceptable.
17. Modem service will be capable of displaying load cell zero calibration counts, current zero counts and actual mV/V output of each cell simultaneously. A printed report of this information is possible from the modem software.
18. Modem service will be capable of performing a self-test on all communications ports and report the current setup.
19. Original calibration values shall have the capability to be retrieved and stored via modem.
20. Original configuration values shall have the capability to be retrieved and stored via modem.
21. For non-commercial applications, scales shall have the capability to be set up and calibrated via modem.

B.7 TICKET PRINTER REQUIREMENTS

Provide the following:

1. Provide one laser-type printer
2. Minimum print speed of 12 pages per minute
3. Minimum print quality of 600 dpi
4. Minimum 8 Mb of memory

B.8 SCOREBOARD SIGN REQUIREMENTS

Four displays will be supplied. One to display the axle weights on each of the three weigh pads and one to display the GVW. Scoreboards shall be able to be turned off and on from the manual override console. Each display will meet the following specifications:

Display	Six digits, ≥ 5 inches high
Viewing Distance	Up to 160 feet
Maximum cable length	1000 feet (20 mA 50 feet (RS232C))
Power	117 VAC + 15% 50/60 Hz 1.2 amps
Enclosure	NEMA 3 rated
Input	RS232 or 20mA (active or passive)
Digital Color	Fluorescent yellow or red
Lighting	Internal Fluorescent light(visible at night) or LED
Storage Temp.	0F to 150F (-18C to 66C)
Humidity	0% to 100% non-condensing

C Warranty

The Static Scale System vendor shall warrant and maintain all subsystems and system components as supplied and installed for five years from the date of acceptance by the engineer. This warranty and associated maintenance work are defined and covered under a separate bid item, Static Scale System Warranty Maintenance

D Measurement

The department will measure Static Scale System, completed in accordance with 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.0105.201	Static Scale System	LS

Payment is full compensation for furnishing and installing all materials; coordinating and making all utility hook-ups; making the system operational; testing; providing required training and warranties; and for furnishing all labor, supervision, equipment, tools, and incidentals necessary to complete the contract work. Materials and equipment included in the Static Scale System are a Triple Platform Static Scale including instrumentation, printer, four-line scoreboard, cabling, weighing platforms, pit construction and excavation. Scope of work includes setting load cells and weighbridge, backfilling with existing excavated materials, any gravel, any backfill or extra fill to complete scale, approach slabs, and warranty, and calibrating and testing.

51. Weigh-In-Motion System Warranty Maintenance, Item SPV.0105.202.

A Description

P Provide warranty and maintenance service for the weigh-in-motion scale system for a period of five years. This system includes weigh-in-motion scales, sensors, cameras, system components and ancillary equipment. Provide routine maintenance on all major systems, system components and ancillary equipment at 6-month intervals. Provide emergency repair services on an as-required basis.

A.1 Warranty Bond

The contractor shall provide a warranty bond for the Weigh-In-Motion System Warranty Maintenance. The bond will be in effect for the entire five year warranty period beginning when the Weigh-In-Motion Scale System is completed, operational and accepted. The bonding company must have an AM Best rating of "A-" or better and the contractor will provide proof of a five year bond commitment before execution of the contract.

The warranty bond amount will be for \$60,000. The bond will ensure the proper and prompt completion of required warranty work following completion of the contract work, including payments for furnishing all labor, equipment, and materials used according to this specification.

The contract bond, which remains in effect for one year beyond the completion of the project, will also include warranty work as described in this article. For the remaining four year warranty period, provide documentation that the warranty bond will be provided in a single term four year warranty bond.

Failure of the contractor or its surety to issue the warranty bond will be considered a default and will result in forfeiture of the face amount of the bond to the department.

All warranty work will be as prescribed in this article. At the end of the warranty period, the contractor will be relieved of the responsibility to perform further warranty work, provided all previous warranty work has been completed.

Maintain insurance, in the course of performing warranty work, as specified in standard spec 107.26 throughout the five year warranty period.

B (Vacant)

C Methods

The WIM vendor shall warrant all subsystems and system components as supplied for five years from the date of issuance of the certificate of final acceptance of the mainline, ramp and virtual WIM Systems by the engineer.

The warranty shall cover all WIM system components, hardware and software, included in the contract for any defects in material and workmanship. This shall include:

1. All loops, WIM Scales, off scale sensors and piezoelectric sensors on site.
2. Interface operations, system electronics and housing cabinet.
3. WIM cables, connectors, terminal strips and back-up batteries.
4. Notification signs and structures.
5. Communication systems.
6. Overview image cameras and equipment.
7. Mainline sorting systems
8. LED OPEN/CLOSED and Arrow ↗/CLOSED signs
9. Ramp Lane Control systems
10. Virtual Weigh Station systems
11. Electrical power wiring and conduit.
12. Weigh Station computer system.
 - a. Scale Manager
 - b. Vehicle Display
 - c. Station PC
 - d. Override Console
13. Printer (if existing not used).

The warranty agreement shall include all:

1. Emergency repair service..
2. Routine maintenance service at 6-month intervals.
3. Mobilization, parts, labor and shipping.
4. Equipment updates, upgrades, modifications and recalls.
5. System interface and electronics updates, upgrades, modifications and recalls.
6. Traffic control.
7. Training for major system updates or upgrades.
8. Operator refresher courses.

The weigh-in-motion system shall be warranted by the WIM vendor, in writing, against defects in or from material, workmanship, lightning, and to perform as required by these technical special provisions, giving proper and continuous service under all conditions required and specified, or which may reasonably be inferred, for a period of five years from the date of acceptance. The written vendor's warranty shall be furnished to the engineer by the vendor at the time the equipment performance supporting data is submitted. The ramp sorter equipment weighing instruments, load cells, weigh bridge, hardware, and software shall be warranted by the manufacturer, in writing, against defects in or from material, workmanship, lightning, rodents and perform as required by these technical special provisions for the specified period or as described above from the date of final acceptance of the project.

The operation and maintenance of all AVI equipment, as well as all AVI-related subsystems, shall be warranted by Pre-Pass or Drivewyze. This equipment will not be included within the scope of the warranty as seen in this specification.

C.1 Scheduled Maintenance Services

The scheduled maintenance service shall include the following:

1. Visual inspection, signal checks and testing measures on all loops.
2. Cleaning, repair and testing measures on all WIM Scales (Mainline, Ramp and Virtual WIM Scale Systems).
3. Visual inspection and testing measures on all off-scale sensors.
4. Visual inspection, testing measures and signal checks on all piezoelectric sensors. Visual inspection and cleaning of cabinet and system electronics.
5. Maintenance of WIM cables, connectors, terminal strips and back-up batteries.
6. Electrical inspection.
7. Cabinet mechanical condition inspection.
8. Heating, ventilation and air conditioning maintenance.
9. Interface card operation inspection, testing measures and maintenance.
10. Notification sign inspection, testing and maintenance.
11. Structural integrity check of all poles and mast arms.
12. Inspection and verification of computer communication systems.
13. Camera inspection, testing and maintenance, including cleaning of camera lenses.
14. Parts, labor and shipping.
15. Mobilization and traffic control necessary to perform the maintenance services.
16. WIM scale accuracy and calibration.

17. Check and record all load cell readings (raw counts, millivolts, ohms and grounding) and provide in report.
18. Perform linearity and repeatability tests then adjust as required. This test must be performed with a minimum 4,000 LBS certified test weights.
19. Apply certified test weight for calibration and adjust as required. This test must be performed with a minimum 4,000 LBS certified test weights.
20. Perform in-motion tests and adjust as required to comply with standards
21. Provide print outs of the test.
22. WIM scale maintenance
23. Lubricate load cell bolts.
24. Remove all grease and apply new grease to O-rings and pins.
25. Visually check scale platforms for visible damage.
26. Remove cover plates, preload bolts, and anti-lift bolts and check platform for level or rocking.
27. Remove platform.
28. Check shims for damage and replace as needed.
29. Remove load pin from load cells and check gasket for wear.
30. Check torque on load cell bolts (390 feet lbs.).
31. Check all bolts in frame for tightness.
32. Reinstall platform, pre-load bolts torque (300 feet lbs.), and install anti lift blocks (1/32 gap).
33. Replace shims and o-rings.

A report shall accompany the scheduled maintenance service and shall be submitted to the department. The report shall include:

1. Pass/Fail grading of all loops, scales, off-scale sensors and piezoelectric sensors.
2. A checklist of all components checked as listed above, as well as the location of the components and comments on their general state.
3. A checklist and commentary detailing whether each component (as listed above) met standards or required repairs.

C.2 Emergency Repair Services

Emergency repair services shall be completed on an as-required basis. The maximum response time for emergency repair services shall not exceed 48 hours after written receipt of notice by fax. The vendor shall initiate on-site repairs within 3 business days of notification. Emergency repair services shall include all parts, labor, shipping, mobilization and traffic control necessary to perform the work.

C.3 Operator Refresher Courses

In conjunction with the scheduled maintenance services, the Vendor shall provide Operator Refresher Courses on the operation of the entire Mainline, Ramp and Virtual WIM system upon request. The courses shall have a maximum duration of four hours and shall be scheduled before or after the semi-annual maintenance service. The course attendees shall be decided by the department

D Measurement

The department will measure Weigh-In-Motion System Warranty Maintenance, as a single lump sum unit of work completed and accepted in accordance to the terms of the contract.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.202	Weigh-In-Motion System Warranty Maintenance	LS

Payment is full compensation for providing the warranty bond, all warranty maintenance service and emergency repair service for a period of five years and shall include all labor, tools, parts, shipping, mobilization, traffic control and incidentals necessary to perform the maintenance service.

52. Static Scale System Warranty Maintenance, Item SPV.0105.203.

A Description

Provide warranty and maintenance service for the Static Scale System for a period of five years. Provide routine maintenance on all major systems, system components and ancillary equipment at annual intervals. Provide emergency repair services on an as-required basis.

The static scale equipment shall be warranted by the manufacturer, in writing, against defective in or from material, workmanship, lightning, and to perform as required by these technical special provisions, giving proper and continuous service under all conditions required and specified, or which may reasonably be inferred, for a period of five years from the date of acceptance. The manufacturer's routine maintenance schedule shall be stated. The written manufacturer's warranty shall be furnished to the department by the contractor at the time the equipment performance supporting data is submitted. The warranties shall also state they are subject to transfer to the department.

The static scale equipment weighing instruments, load cells, weigh bridge, deck and hardware shall be warranted by the manufacturer, in writing, against defects in or from material, workmanship, lightning, and perform as required by these technical special provisions for the period of five years or as described above from the date of final acceptance of the project.

The manufacturer shall also provide an extended five-year warranty on static scale load cells. This warranty shall take effect at the conclusion of the initial five-year warranty. This extended five-year warranty shall exclude labor, freight, and travel. Alternatively, at completion of the five-year warranty, the manufacturer may furnish eight spare load cells to be used for scale repairs in lieu of the extended five-year warranty.

A.1 Warranty Bond

The contractor shall provide a warranty bond for the Static Scale System Warranty Maintenance. The bond will be in effect for the entire five year warranty period beginning when the Static Scale System is completed, operational and accepted. The bonding company

must have an AM Best rating of “A-“ or better and the contractor will provide proof of a five year bond commitment before execution of the contract.

The warranty bond amount will be for \$25,000. The bond will ensure the proper and prompt completion of required warranty work following completion of the contract work, including payments for furnishing all labor, equipment, and materials used according to this specification.

The contract bond, which remains in effect for one year beyond the completion of the project, will also include warranty work as described in this article. For the remaining four year warranty period, provide documentation that the warranty bond will be provided in a single term four year warranty bond.

Failure of the contractor or its surety to issue the warranty bond will be considered a default and will result in forfeiture of the face amount of the bond to the department.

All warranty work will be as prescribed in this article. At the end of the warranty period, the contractor will be relieved of the responsibility to perform further warranty work, provided all previous warranty work has been completed.

Maintain insurance, in the course of performing warranty work, as specified in standard spec 107.26 throughout the five year warranty period.

B (Vacant)

C Methods

C.1 Maintenance Services

Scheduled maintenance services shall be performed annually during autumn of the year. The scheduled maintenance service shall include the following:

1. Visual inspection of the static scale system.
2. Calibration of the scale.
3. Lubrication of load cells and bumpers.
4. Power washing of the scale deck and pit with 2500 psi minimum pressure washer.
5. Parts, labor and shipping.
6. Mobilization and traffic control necessary to perform the maintenance services.

A report shall accompany the scheduled maintenance service and shall be submitted to the department. The report shall include:

1. Calibration process and results.
2. Work completed.
3. Evaluation of the static scale system.
4. Other comments.

C.2 Emergency Repair Services

Emergency repair services shall be completed on an as-required basis. The maximum response time for emergency repair services shall not exceed 48 hours after written receipt of notice by email or fax. The vendor shall initiate on-site repairs within three calendar days of notification. Emergency repair services shall include all parts, labor, shipping, mobilization and traffic control necessary to perform the work.

D Measurement

The department will measure Static Scale System Warranty Maintenance as a single lump sum unit of work, completed and accepted in accordance to the terms of the contract.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.203	Static Scale System Warranty Maintenance	LS

Payment is full compensation for providing warranty and all maintenance services and emergency service for a period of five years, the load cell extended five year warranty and shall include all labor, tools, parts, shipping, mobilization, traffic control and incidentals necessary to perform the maintenance services.

53. Communications Tower, Item SPV.0105.301.

A Description

This special provision describes the design and general construction work for the SWEF communications tower. The work includes the design, excavation, concrete base, monopole, cabling, transmission line bridge, ground grid, building entry and associated equipment. The work shall be according to the plans and the following specifications.

B General

Section 02010 – Subsurface Investigation

Project soil boring logs are shown in the plans.

Section 02370 - DRILLED CONCRETE PIERS

This section provides information common to two or more technical site work specification sections or items that are of a general nature, not conveniently fitting into other technical sections. This section applies to Drilled Piers (Drilled Shafts, Caissons or Bored Pile Foundations), as applicable.

Included are the following topics:

PART 1 - GENERAL

1. Scope
2. Definitions
3. Related Work and Provisions
4. Reference Standards
5. Submittals
6. Project Conditions
7. Quality Assurance
8. Codes
9. Certificates and Inspections

PART 2 - PRODUCTS

1. General
2. Steel Casing
3. Reinforcing Materials
4. Accessory Materials
5. Concrete Materials
6. Admixtures
7. Slurry Properties

PART 3 - EXECUTION

1. Excavation of Shaft
2. Tolerances
3. Reinforcement Placement
4. Placement of Concrete
5. Cold Weather Placement
6. Hot Weather Placement
7. Concrete Finishes
8. Curing
9. Protection
10. Repairing and Patching
11. Field Quality Control

PART 1 – GENERAL

1. Scope

This special provision describes providing all work, materials, labor, equipment, and supervision necessary to perform the work on the site as provided for in the technical specifications and on the drawings.

Work on the Sparta SWEF Communications Tower shall conform to all requirements of ACI 336-97 Reference Specifications for the Construction of Drilled Piers, published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by the requirements of these Contract Documents.

This project and specification deals with the design and construction of foundations made of reinforced concrete. Its scope is limited to piers constructed by digging, drilling or otherwise excavating a hole in the soil which subsequently is filled with concrete, and does not include rectangular piers on spread footings in deep excavations. Installation without excavation, by methods such as mortar intrusion, mixed-in-place, and similar procedures are not considered applicable for this project.

2. Definitions

Owner – State of Wisconsin, Department of Transportation, Division of State Patrol, Bureau of Specialized Services.

Owner's Representative – For this project, the State of Wisconsin, Department of Transportation, Division of Transportation System Development, Southwest Region-La Crosse Office, Engineer.

3. Related Work & Provisions

This section relates to all Division 2 sections as they pertain to site work and to Division 3 sections as they pertain to concrete work.

Applicable provisions of Division 1 shall govern all work under Division 2 and Division 3 of the specifications.

4. Reference Standards

Comply with all provisions of the following codes and standards except as modified herein.

All referenced codes and standards including all revisions and commentaries shall be the most currently adopted as of the date of these contract documents.

Abbreviations of standards or organizations referenced in this specification are as follows:

American Concrete Institute (ACI)

ACI Building Code Requirements for Reinforced Concrete

Comply with all ACI Standards including Sections 211, 301, 302, 303, 304, 305, 306, 308, 311, 336, 347.

American Welding Society (AWS)

AWS D1.1 Structural Welding Code - Steel

AWS D1.4 Structural Welding Code - Reinforcing Steel

American Society For Testing and Materials (ASTM)

- A-36 Specification for Structural Steel
- A-496 Specification for Deformed Steel Wire for Concrete Reinforcement
- A-615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- A-706 Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement
- C-33 Specification for Concrete Aggregates
- C-109 Test Method for Compressive Strength of Hydraulic Cement Mortars
- C-150 Specification for Portland Cement
- C-171 Specification for Sheet Materials for Curing Concrete
- C-260 Specification for Air-Entraining Admixtures for Concrete
- C-494 Specification for Chemical Admixtures for Concrete

Comply with ASTM Standards including Sections A82, A185, A775, C31, C39, C94, C143, C172, C231, C309, D175.

Concrete Reinforcing Steel Institute (CRSI)

Manual of Standard Practice

Recommended Practice for Placing Reinforcing Bars

Deep Foundations Institute: DFI-ADSC Drilled Shaft Inspections Manual

ADSC: The International Association of Foundation Drilling:

DFI-ADSC Drilled Shaft Inspectors Manual

ADSC Down-Hole Entry Manual

ADSC-FHWA The Effects of Free Fall Concrete in Drilled Shafts

Federal Highway Administration:

FHWA-RD-92-004 Drilled Shafts for Bridge Foundations

International Building Code and Wisconsin Enrolled Commercial Building Code

Supplier is responsible for obtaining State of Wisconsin Department of Commerce approval for products being supplied prior to fabrication.

5. Submittals

Shop Drawings - Refer also to Section GC - General Conditions of the Contract

Submit shop drawings prior to fabrication that show sizes and dimensions for fabrication and placing of reinforcing steel and bar supports. Indicate bar schedules, stirrup spacing and diagrams of bent bars, arrangements, lap lengths and assemblies.

6. Project Conditions

Subsurface Investigation; review results of the subsurface investigation as presented in Section 02010 of the Contract Documents.

7. Quality Assurance

Substitution of Materials: Refer to Section GC - General Conditions of the Contract.

The engineer shall be notified upon completion of the shaft excavation and will determine the acceptability of the excavation prior to placement of reinforcement and concrete fill.

8. Codes

Comply with the requirements of International Building Code and Wisconsin Enrolled Commercial Building Code whenever applicable.

9. Certification And Inspections

Refer to Section GC - General Conditions.

Obtain and pay for all required sampling, testing, inspections and certifications except those provided by the engineer. Deliver originals of certificates and documents to the Division's construction representative.

PART 2 – PRODUCTS

1. General

This Section covers minimum general requirements for materials and products in connection with construction of the drilled pier.

Final design of the drilled pier tower support foundation shall be the responsibility of the Tower Contractor and his engineer.

2. Steel Casing

Permanent steel casing is not part of the proposed shaft structure and is not shown on the project drawings.

Temporary steel casing required by field conditions may be required, but is not shown on the project drawings. If required temporary casing shall have sufficient wall thickness and strength for handling stresses and to resist all soil and water pressures. Temporary casing provided by the contractor, as required, will be at no additional cost to the department.

3. Reinforcing Materials

Billet Steel: ASTM A615, Grade 60 for all reinforcing. Minimum grade.

4. Accessory Materials

Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place: Provide spacer rollers to maintain clear cover between reinforcement cage and pier excavation.

For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with plastic protected legs or similar spacers.

Embedded fabricated tower anchor bolts and fabricated template(s) shall be hot dipped galvanized per ASTM A153.

5. Concrete Materials

Use concrete and concrete work conforming to ACI 301, particularly Sections 1, 4 and 5.

The minimum 28-day concrete strength shall be 4500 psi, maximum aggregate size 3/4 inches, minimum slump of 5 to 6 inches and 6% air-entraining admixture.

Portland Cement: For normal concrete, ASTM C150, Type I or Type II. Use only one brand of cement throughout the project.

Aggregates: Conform to ASTM C33. Coarse aggregates shall not contain more chert and other deleterious substances than allowed by Table 3 in ASTM C 33.

Fine Aggregate: Natural sand.

Coarse Aggregate: Crushed stone or gravel for structural concrete.

Grout: Cement grout conforming to ASTM C 845-76T, Compensation for shrinkage.

Water: Clean, fresh, free from oil, acid, organic matter or other deleterious substances.

6. Admixtures

Air-Entraining: ASTM C 260.

Water-Reducing: ASTM C496, Type A, "Pozzolith 220-N" by Master Builders or approved equivalent.

Water-Reducer/Retarder: ASTM C 494, Type D, Pozzolith 100-XR" by Master Builders or approved equivalent

Super Plasticizer: ASTM C 494, Type F, "WRDA-19" by Grace or approved equivalent.

Fly Ash: ASTM C 618 C.

Calcium Chloride (or admixtures containing calcium chloride): Not permitted.

7. Slurry Properties

As required per Table 2.6 of ACI 336.

PART 3 - EXECUTION

1. Excavation of Shaft

The minimum amount of loose material or water at the base of excavation permissible in the drilled shaft at time of concrete placement shall not exceed two (2) inches.

Depth of shaft shall be based upon Tower Contractor's design with approval of the engineer upon completion of the shaft excavation.

Provide minimum shaft diameter shown on the project drawings or larger as designed by the Tower Manufacturer. Diameters larger than shown on the drawings shall be submitted to the engineer for approval.

Tower Contractor's design engineer shall determine final depth of pier foundation and determine actual final bearing levels during excavation. Bottom elevation of drilled pier shown on project drawings is based upon the geotechnical report and is an estimated depth for bid purposes. The unit price requested in the bid form is for greater or lesser foundation depth and will be used as a unit add or deduct price for above and below design foundation depth. No adjustment in unit price will be made for foundation diameters larger than that indicated on the drawings.

2. Tolerances

Use tolerances according to ACI 117 except as noted below.

Forms shall conform to the shape, lines and dimensions as called for on the drawings and shall be substantially tight to prevent leakage of mortar. Provide $\frac{3}{4}$ inch chamfers at all exposed concrete edges.

Set and build into the work anchorage devices and other embedded items required for the other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

3. Reinforcement Placement

Provide reinforcement per the Tower Contractor's design.

The reinforcement steel shall be designed as a structural element and braced to retain its configuration throughout the placed of concrete and extraction of the casing from the shaft if used.

Install reinforcement in strict conformance with approved shop drawings and all CRSI recommendations.

Notify the engineer at least 24 hours in advance of concrete pours to enable their review of reinforcement in place prior to concrete placement.

Tend to reinforcing at all times during concrete placement and make necessary adjustments to reinforcing and other embedded items which have been dislodged by concrete placement or workmen.

4. Placement of Concrete

No water shall be added to batch mix at the building site.

Place all concrete according to ACI 304 Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete and ACI 304.2R Placing Concrete by Pumping Method.

Free fall of concrete placement will be allowed in dry excavations and at depths less than 50 feet. Avoid hitting the reinforcement cage upon placement of concrete.

Placement of concrete by tremie method or pumping may be used.

5. Cold Weather Placement

When winter construction is anticipated, the Contractor is expected to continue to pour concrete during normal winter weather conditions.

Protect concrete work from physical damage or reduced strength caused by frost, freezing actions or low temperatures with ACI 306 Recommended Practice for Cold weather Concreting.

Do not place concrete during any day when the mean daylight temperature is less than 20° F.

Do not place concrete during inclement weather conditions, for example during rain, snow or hail.

6. Hot Weather Placement

When weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 Recommended Practice for Hot Weather Concreting. Do not place concrete when the air temperature is above 90° F.

During hot weather or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

7. Concrete Finishes

Float and Broom Finish: Exposed surfaces and provide 3/4-inch chamfer on exposed edges.

8. Curing

Moist Curing

All exposed surfaces shall be cured per ACI 308 2.3.1 Plastic Film or 2.3.2 Reinforced Paper only for 7 days after placement. Curing system shall be sealed and moisture added daily to maintain concrete surface in a damp condition. Insulating blankets used during cold weather do not need sealed joints as long as concrete surface is damp. After 7 days of moist curing, apply liquid membrane system.

9. Protection

Protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

10. Repairing and Patching

Comply with ACI 301 – Specifications for Structural Concrete for Buildings.

Remove and replace at no cost to the owner all concrete not formed as indicated, concrete out of alignment, surfaces exceeding tolerances or defective surfaces which cannot be repaired or patched. Include concrete failing to meet strength requirements as reported the testing laboratory.

Clean, dampen and fill all bolt, tie holes, poor joints, voids, honeycombs and other similar defects with patching concrete immediately after removing forms. Remove all fins.

11. Field Quality Control

General: Test all concrete in the manner specified below:

Specific Tests, Inspections and Methods Required.

Testing: Slump and air content tests shall be made at the option of the owner's project representative to substantiate mix designs.

Perform slump tests according to ASTM C 143 and air content tests according to C 231.

Test Cylinders: Cylinders for strength test shall be made according to ASTM C 31. Each test shall consist of a minimum of three cylinders. One tested at 7 days and two cylinders at 28 days.

Strength test shall be made for each day's pour, each class of concrete, each change of supplier and for each 100 cubic yards of concrete.

The engineer may waive testing requirements after consistency has been shown.

END OF SECTION 02370

Section 02780 - Tower

This section provides information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. This section applies to ALL the communications tower structure and all supporting elements, as applicable.

Included are the following topics:

PART 1 - GENERAL

1. Scope
2. Summary of Work Included
3. Related Work and Provisions
4. Reference Standards
5. Design
6. Quality Assurance
7. Equipment and Materials Furnished by Others
8. Submittals
9. Warranty
10. Certificates and Inspections
11. Operating and Maintenance Instructions
12. Training of Owner Personnel
13. Record Drawings

PART 2 - PRODUCTS

1. Materials
2. Obstruction Lighting
3. Painting
4. Special Conditions

PART 3 - EXECUTION

1. General
2. Erection of Tower
3. Completion of Project

PART 1 -GENERAL

1. Scope

The work under this section includes minimum requirements for the analysis, design, fabrication and erection of a free standing steel monopole tower and drilled pier support foundation which will be a part of the point-to-point communications system as provided for in the technical specifications and on the drawings.

The tower shall be capable of holding all antennas shown on Drawing SP-1. Design loading criteria is covered later in this section.

All work shall be in accordance to applicable manufacturer's instructions.

2. Summary of Work Included

Provide personnel and equipment to install the antennas and lines listed on sheet SP-1 of the drawings. All transmission lines associated with the dish antennas shall be EW63 or equivalent, all other transmission lines shall be 1-5/8-inch jacketed coax. Transmission lines shall be installed within the monopole structure through entry/exit ports and hand

holes. Install all hoist grips, two grounding kits per line, plus associated rigging and tagging.

Provide hardware for attachment of hoist grips to the tower as required.

Align the dish antenna(s) when installation is complete. For the alignment, furnish personnel for each end of the path under alignment.

There will be 1 alignment path; the path will have 2 dishes, one at each end: Sparta SWEF site to Tomah site, azimuth $\pm 90^\circ$

Provide mounting brackets for all antenna indicated on Drawing SP-1. Mounting bracket for each parabolic antenna shall be 4½-inches (outside diameter) pipe, and for whip type antennas shall be 2-inches (outside diameter minimum) pipe with all materials to mount the pipe to the tower. Brackets shall be installed at specified heights and shall be designed so that unit stresses resulting from specified loads do not exceed allowable stresses of the "Specification for Structural Steel Buildings – Allowable Steel Design and Plastic Design" issued by the American Institute of Steel Construction.

Design and provide antenna supports as indicated on Drawing SP-1 and provide entry/exit ports and hand holes for installation of waveguide and coax cables within tower structure.

Sidearm antenna supports shall be designed and layout in a manner indicated on the drawings with adequate bracing to prevent distortion and antenna strikes during wind gusts.

Furnish and install a waveguide bridge (outside cable tray) and associated supports and foundations from the tower to the adjacent building. Bridge shall be provided with ice shield, and shall be sized to accommodate all transmission lines shown on Drawing SP-1. Cable bundling is not permitted. Waveguide bridge shall be bonded to tower, buried ground grid and existing interior building ground bus.

The engineer shall approve the contractor's proposed grounding system at the tower base location prior to installation.

All antennas, lines and associated hardware provided by the department will be located at the Wisconsin State Patrol Radio Shop, 3633 Pierstorff Street, Madison, Wisconsin. The Contractor is responsible for transportation of this equipment from this location to the job site.

Cleanup the site of all refuse associated with this contract. Remove all crates, reels and other refuse associated with the antennas and line shipping.

3. Related Work And Provisions

This section relates to all Division 2 and Division 3 and other applicable Division sections as they pertain to the tower structure.

This specification shall apply to all tower structure work unless otherwise specified. Refer to Section 02370 – Drilled Concrete Piers, relative to the tower foundation work.

Applicable provisions of Division 1 shall govern all work under Division 2 and 3, and all Division 2 and 3 specifications.

4. Reference Standards

Abbreviations of standards or organizations referenced in this specification are as follows:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	Manual of the American Institute of Steel Construction
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CS	Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
EPA	Environmental Protection Agency
EIA	Electronic Industries Association
FS	Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
UL	Underwriters Laboratories Inc.
IEEE	Institute of Electrical and Electronics Engineers
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
TIA	Telecommunications Industry Association

Where reference is made to the "standard specifications", it shall be construed to mean the pertinent sections of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction (SSHSC), current edition, and all supplemental and interim supplemental specifications, as they may pertain.

5. Design

The tower shall be designed, fabricated and erected in accordance to TIA/EIA-222-F Standard, including the latest revisions. Comply with EIA Specifications for twist and sway as they relate to the tower and antenna support brackets.

The design, fabrication and erection shall conform to the requirements of the Federal Communications Commission, Federal Aviation Administration, Wisconsin Department of Aeronautics, the National Electrical Code, International Building Code and Wisconsin Enrolled Commercial Building Code.

For this project the tower shall be designed for 90 MPH (fastest-mile) wind load. Tower shall conform to TIA.EIA RS-222-F, latest revisions. Calculations shall include 1/2-inch radial thickness of ice coating on all members of the structure.

Analysis and design shall include 1/2-inch radial thickness of ice coating on all members of the structure. When this ice loading is considered, the wind load shall be reduced 25 percent when considered to occur simultaneously with ice (equivalent to 87 percent of the basic wind speed). Wind loads shall be considered basic design loads with no increase in allowable unit stress permitted.

Any known conflicts between these specifications or drawings, and codes, as well as any suspected error in these specifications or plans shall be brought to the attention of the engineer.

Design analysis, erection drawings and foundation drawings shall be certified by a Registered Professional Engineer licensed in the State of Wisconsin.

Tower foundation shall be designed to match the soil conditions provided in the subsurface soil exploration report. Refer to Section 02010 - Subsurface Investigation. If subsurface conditions are found to be materially different from those described, then the provisions of Article 2, General Requirements shall apply. Refer to Section 02370 – Drilled Concrete Piers for specific foundation requirements.

All components of the tower and support elements shall be designed so that the unit stressed resulting from specified loads shall not exceed the allowable stresses of the “Specification for the Design, Fabrication and Erection of Structural Steel Buildings” issued by the American Institute of Steel Construction. However, wind loads shall be considered basic design loads with no increase in allowable unit stress permitted.

6. Quality Assurance

Substitution of Materials: Refer to Section GC - General Conditions of the Contract.

Where equipment, accessories, or materials are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated in the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

All ground and aerial work shall be performed by persons equipped and qualified to do so. Furnish, upon award of tower contract, evidence of adequate bonding and insurance to hold the State harmless in completion of the contract issued for this work.

The contractor shall be experienced in the installation and alignment of microwave parabolic antennas. Furnish a list of at least three references where microwave parabolic antennas were installed and aligned.

Visit the tower site to verify the site specific data and drawings. Any expense and delay due to lack of information shall be the contractor's responsibility.

The contractor shall be responsible for the engineering, fabrication, delivery and installation of the tower and tower foundation as described on site-specific data sheets and the following specifications.

7. Equipment and Materials Furnished By Others

The department will furnish all antenna and mounting hardware for attachment to three 2-inch diameter mounts. The department shall furnish the dish antenna and dish mounting brackets for attachment to a 4 1/2-inch outside diameter pipe. The department will install the connections on the coax and waveguide.

The owner will furnish the hoist grips and coax waveguide hangers plus the hanger mounting bolts.

The owner will furnish stainless steel clamps and attachment hardware for the transmission lines.

8. Submittals

Refer also to Section GC - General Conditions of the Contract.

Submit manufacturer's preproduction (shop) drawings for any offsite constructed sitework items for approval prior to the start of manufacturing.

All submittals must receive full approval of the engineer prior to tower manufacture and erection.

Four additional copies of all design analysis and material certification, approval information shall be provided the user agency (Department of Transportation, Division of State Patrol, Bureau of Specialized Services) for their records.

The plans submitted to the engineer shall include a site plan and drawings showing tower configuration and foundation, four copies of submittal are required. Submittal of calculations showing that the foundation will resist over-turning and applied horizontal forces are also required.

Drawings

The following drawings shall be submitted to the engineer for approval prior to fabrication of the tower:

- a. Cover sheet showing station name, tower height, manufacturer's name and model number;
- b. Elevation and plan view showing tower orientation. Precise antenna/reflector location and bearings, light levels as required, plus any pertinent notes.

- c. Tower base foundation and associated concrete reinforcement details, plan and elevation views. Drawing shall include such information as reinforcement bar size, quantity and position, cubic yards of concrete, concrete finishing techniques, grounding details and other pertinent information.
- d. Tower section drawings showing all tower members, splice plates, antenna supports, entry/exit ports and hand holes, and any other information needed to identify each portion of the tower. Show dimensions of all tower members including the location and size of each bolt hole.
- e. Drawing showing tower base details and hardware details.
- f. Drawing showing transmission line bridge and associated supports.
- g. Drawing of miscellaneous details such as antenna mounting, permanent climbing rungs, waveguide position and mounting details.

Four additional copies of all drawings and information shall be furnished to the user agency (Department of Transportation, Division of State Patrol, Bureau of Specialized Services) for record files.

Structural Analysis

Submittal requirements: A complete and detailed structural analysis shall be performed on the proposed tower structure. Tower supplier shall submit all input parameters and calculations used to determine the stresses, proportion the members and design the connections of the tower support elements. Design safety factor values shall be supplied.

Minimum requirements: Tower shall be analyzed per TIA/EIA-222-F, latest revision.

9. Warranty

The tower supplied under this specification shall be warranted to be free of defects for a minimum period of five (5) years from the date of substantial completion. Tower defects in materials or workmanship during this period and any materials and equipment damage because of defects, shall be repaired or replaced at no cost to the owner.

This warranty shall not be void by the owner's use of other competent contractors to install antennas or transmission lines on the tower when the work is consistent with the initial design and acceptable to the owner.

Warranty service shall be provided and repairs completed within 24 hours following notification of contractor by owner that a failure covered by the warranty provisions has occurred. Furnish owner with a telephone number at which contractor, or his representative, may be reached 24 hours a day, seven days a week, notification of in-warranty failures.

Warranty bond. The required warranty bond for the Communications Tower will be in effect for the entire 5-year warranty period. The bonding company must have an AM. Best rating of "A-" or better and the contractor will provide proof of the bond commitment before execution of the contract.

The warranty bond will be for \$20,000. The bond will ensure the proper and prompt completion of required warranty work for the duration of the warranty period, including payments for all labor, equipment, parts, materials used and delivery according to this specification.

Provide documentation that the warranty bond will remain in effect for the duration of the warranty period. For the first year of the warranty bond, provide documentation that the contract bond, which remains in effect for one year beyond the completion of the project, will also include warranty work.

If a subcontractor installs the communications tower, the subcontractor may provide the warranty bond for the remaining warranty period after expiration of the contract bond. If the subcontractor does provide the bond, it shall be a dual obligee bond, naming the contractor and the Wisconsin Department of Transportation as obligees. The subcontractor will provide documentation that the warranty bond will remain in effect for the portion of the warranty period after expiration of the contract bond.

Failure of the contractor, subcontractor or its surety to issue or renew the warranty bond will be considered a default and will result in forfeiture of the face amount of the bond to the department.

All warranty work will be as specified above. At the end of the warranty period, the contractor will be relieved of the responsibility to perform further warranty work, provided all previous warranty work has been completed.

10. Certifications and Inspections

Refer to Section GC - General Conditions.

Obtain and pay for all required sampling, testing, inspections, and certifications except those provided by the engineer. Deliver originals of certificates and documents to the Division's construction representative. Include copies of the certifications and documents in the Operating and Maintenance Instructions.

11. Operating and Maintenance Instructions

Refer to Section GR - General Requirements.

Assemble material in an operating and maintenance manual composed of three-ring or post binders, using and index at the front of each volume and tabs for each system or type of equipment installed. In addition to the data indicated in the General Requirements, include the following information:

- a. Copies of all approved shop drawings
- b. Records of tests performed to certify compliance with system requirements
- c. Parts lists for manufactured equipment
- d. Warranties and/or guarantees
- e. Additional information as indicated in the technical specification sections

12. Training of Owner Personnel

Instruct owner personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include instruction, using the Operating and Maintenance manual during this instruction. All training to be done during normal work hours.

13. Record Drawings

Refer to Section GR - General Requirements.

Maintain and provide record drawings of all as-built system installations and points of connection made as part of this project. Include copies of record drawings with the Operating and Maintenance instructions.

PART 2 – PRODUCTS

1. Materials

Materials shall be per TIA/EIA-222-F.

All structural materials and fabricated parts shall be galvanized in accordance to ASTM A-123 (Hot-Dip). Including but not limited to the monopole structure, antenna supports, ice bridge and associated hardware.

Tower shall be designed and fabricated so that erection may be accomplished using bolts with no field welding required.

All hardware shall be hot dipped galvanized in accordance to ASTM 153. Including but not limited to antenna support assemblies, access ports, ladder rungs and associated assemblies.

The tower shall be equipped with permanent climbing ladder rungs outside the tower structure.

Furnish and install a safety-climb cable system for monopole towers that meets or exceeds OSHA and ANSI requirements for climbing safety, complete with safety harness.

Furnish and install hand holes and two access ports at tower base as shown on the project drawings.

Each mount standoff support assembly shall be braced back to tower structure to minimize deflections of the antenna such that pole type antenna assemblies do not strike one another or the tower structure under the design basic wind speed.

Support of transmission cables beneath ice bridge between tower and equipment building, provide extended double T-line brackets similar to Pirod/Valmont Model 802176 with 3/4-inch holes. Minimum 3-feet on-center, or as recommended by the cable manufacturer.

Furnish and install transmission line support and ice bridge supported by galvanized steel pipes between tower and building cable entry. At least 3 of the pipe supports shall be 4 inches in diameter schedule 40 steel pipe and extend 4 feet above top of transmission cable ice fall protection.

Provide two ground tabs at the base of the tower: two 1/4-inch thick by 4-inch by 4-inch steel ground tabs for use in attachment of ground conductors.

Furnish and install two copper ground bus bars (one for each access port) near tower base access ports for grounding transmission cables. Copper bus bars shall be for 15 two-hole grounding lugs, minimum copper bar size 1/4-inch x 2-inch x 14-inch (Valmont Communications Part No. B2983 or equivalent). Mount copper ground bus on exterior of tower, but under no circumstance shall copper bar contact galvanized steel tower structure. Provide non-conductive insulator between bus bars and tower structure.

2. Obstruction Lighting

None required.

3. Painting

None Required. Tower structure finish and associated ports, antenna supports shall be galvanized coating in accordance to ASTM A123.

Damage to galvanized coating occurring during transit or erection shall be promptly and properly repaired on site.

4. Special Conditions

Confirm that the owner has a valid FAA construction permit before commencing construction.

PART 3 – EXECUTION

1. General

Designate an employee responsible for all OSHA job safety requirements. The individual shall be on site at all times and have full authority to make safety changes.

Workmanship shall be of the best quality. All work shall be carefully and accurately performed. All members shall be straight and true to the drawings. The blocking, punching, clipping, bending and welding shall be accurately done so that no drifting is necessary in assembly.

Protect all building(s), paved surfaces, landscaping and HVAC equipment during the construction of the tower foundation and erection of the tower. Contractor shall be liable for any damage caused to such building, structure and equipment.

2. Erection of Tower

The tower shall be designed and fabricated so that erection may be accomplished using bolts with no field welding required.

All bolts shall have a minimum of two threads protruding beyond the nut.

Make the connection (bond) between #2 tinned solid copper wire ground conductors and tower base, transmission line bridge and existing cable transmission line structure.

3. Completion of Project

The contractor shall, in the presence of the engineer, conduct a complete demonstration of the system performance.

A complete mechanical inspection of the system shall be conducted to verify compliance with the requirements of these specifications. Project acceptance will be made only after all the following conditions have been met:

- a. The contractor has supplied and installed all equipment specified herein;
- b. All discrepancies noted in the performance inspection and mechanical inspection have been corrected;
- c. Contractor has supplied two copies of "record" as-built drawings and two bound sets of equipment maintenance, operation manuals and warranty documents;
- d. All debris, tools, packing cases, etc., have been removed from the site by the contractor, and;
- e. Owner's technical personnel have been fully instructed in the proper operation, maintenance and repair of the system.

END OF SECTION 02780

Section 16170 - Grounding And Bonding

BASED ON DSF MASTER ELECTRICAL SPEC DATED 6/02/03

Grounding electrodes and conductors, equipment grounding conductors and bonding. Included are the following topics:

PART 1 - GENERAL

1. Scope
2. Related Sections
3. References
4. Grounding Electrode System
5. Performance Requirements
6. Submittals
7. Project Record Documents
8. Qualifications
9. Regulatory Requirements

PART 2 - PRODUCTS

1. Rod Electrode
2. Mechanical Connectors
3. Compression Connectors
4. Exothermic Connections
5. Wire
6. Bus

PART 3 - EXECUTION

1. Examination
2. General
3. Less Than 600-Volt System Grounding
4. Field Quality Control

PART 1 – GENERAL

1. Scope

Applicable provisions of Division 1 shall apply to all work under this Section.

2. Related Sections

Section 02780 - Tower

3. References

NFPA 70 - National Electrical Code.

ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

4. Grounding Electrode System

Ground grid system composed of buried ground wires, rod electrodes to be bonded to the tower structure.

5. Performance Requirements

Grounding System Resistance: 2-ohms maximum at building service entrance.

6. Submittals

Submit under the provisions of Division 1, General Conditions of the Contract, and Section 16010.

Product Data: Provide data for grounding electrodes and connections.

Test Reports: Indicate overall resistance to ground (and resistance of each electrode).

Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

7. Project Record Documents

Submit record documents under provisions of Division 1 and Section 16010.

Accurately record actual locations of grounding electrodes.

8. Qualifications

Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

9. Regulatory Requirements

Conform to requirements of NFPA 70.

Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 – PRODUCTS

1. Rod Electrode

Material: Copper-clad steel.

Diameter: 3/4- inch (19 mm) minimum.

Length: 10-feet (3.5 m) minimum. Rod shall be driven at least 9'-6" deep.

2. Mechanical Connectors

Mechanical connectors may only be used at specified locations, generally only above ground within the confined areas that do not allow use of exothermic connections. Refer to drawings details.

The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of silicon bronze and supplied as a part of the connector body and shall be of the two bolt type.

Split bolt connector types are NOT allowed.

The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

3. Compression Connectors

Compression connectors may only be used at specified locations above ground.

The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.

The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

Each connector shall be factory filled with an oxide-inhibiting compound.

4. Exothermic Connections

Generally shall be used to bond all components of the ground grid above and below ground.

Type: Powdered metal, dry mold type utilizing an exothermic reaction to produce molten copper to melt and weld connections together.

All materials used shall be the same type and by the same manufacturer.

5. Wire

Material: 6AWG stranded copper green insulated (aluminum not permitted), for interior grounding and between exterior cable tray (ice bridge) joints and support(s).

Grounding Electrode Conductor: 2AWG solid tinned copper wire for all exterior grounding as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

Foundation Electrodes: As shown on drawings.

Manhole, Main Switchgear room and Vault Bonding: No. 4/0 minimum.

Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

6. Bus

Material: Copper (aluminum not permitted). Copper bus bar(s) mounted on tower structure adjacent to tower base access ports. Bus bars mounted on tower provided and installed by the Contractor. Contractor shall bond bus bars to buried ground grid.

Contractor to furnish and install copper bus bar ¼-inch x 2-inch minimum.

PART 3 - EXECUTION

1. Examination

Verify that final backfill and compaction has been completed before driving rod electrodes.

2. General

Install products according to manufacturer's instructions.

Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.

Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them. Clean ground rods, wire brush at weld locations, make weld connection and paint area with cold galvanized paint at the completion of bonding process.

Install rod electrodes at locations indicated or as required by Code, whichever requires the most rods. Install additional rod electrodes as required to achieve specified resistance to ground.

Install No. 2 AWG soled tinned copper wire ground ring around the tower support pier foundation perimeter. Provide bonding between this ground ring and radial extensions of the ground as shown on the drawings and where indicated. Refer to drawing details for more information. Engineer will inspect all ground connections before placement of backfill over ground system.

Provide bonding to meet Regulatory requirements.

Bond together existing interior ground leads and bus bar near cable entry to ground grid.

3. Less Than 600-Volt System Grounding

Supplementary Grounding Electrode: Use driven ground rod on exterior of building. Bond together

4. Field Quality Control

Inspect grounding and bonding system conductors and connections for tightness and proper installation.

Use suitable test instrument to measure resistance to ground of system. Perform testing according to test instrument manufacturer's recommendations using the fall-of-potential method. Resistance shall not exceed 2 ohms. Provide written results of resistance measurements to the engineer.

END OF SECTION 16170

System Testing

Run the generator through the standard tests as recommended by the manufacturer including 1 the load bank test. Test the automatic start circuits and run the full diagnostic tests. Verify the fuel and the tank. Check for fuel and coolant leaks.

Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption. After the generator has cooled down from the four hour test, shut it down and then simulate a power failure including operation of the transfer switch, automatic cycle, and automatic shutdown and return to normal.

Check the automatic transfer switches and automatic start circuits for proper function.

C Measurement

The department will measure Communications Tower, completed in accordance to the contract and accepted, as a single complete lump sum unit of work.

D Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.301	Communications Tower	LS

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

54. Removing Weight Scale and Pit, Item SPV.0105.401.

A Description

Remove and dispose of existing truck weight scale and break down and remove the scale pit in accordance to the pertinent requirements of section 204 of the standard specifications and as hereinafter provided.

B (Vacant)

C Construction

All scale materials shall become the property of the contractor.

D Measurement

The department will measure Removing Weight Scale and Pit as a single complete lump sum unit of work, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.401	Removing Weight Scale and Pit	LS

Payment is full compensation for removing and disposing of the existing truck weight scale; breaking down and removing the scale pit; and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

55. Removing Underground LP Tank, Item SPV.0105.402.**A Description**

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

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

The department will measure Removing Underground LP Tank as a single complete lump sum unit of work.

E Payment

Supplement standard spec 204.5 to include the following:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.402	Removing Underground LP Tank	LS

Payment is full compensation for removing and disposing of the existing underground tank; and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

56. Scale Approach Pavement Reinforcement, Item SPV.0180.001.**A Description**

This special provision describes furnishing and installing continuous reinforcement for the scale approach concrete pavement.

B Materials

Furnish steel reinforcement and all other materials as shown in the plans, and according to standard spec 415.2.

C Construction

Install continuous reinforcement within the scale approach concrete pavement as shown in the plans, and according to standard spec 415.3.

D Measurement

The department will measure Scale Approach Pavement Reinforcement by the square yard, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0180.001	Scale Approach Pavement Reinforcement	SY

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

ADDITIONAL SPECIAL PROVISION 3 DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

1. Description

General

- a. The disadvantaged business enterprise (DBE) requirements of 49 CFR Part 26 apply to this contract. The department's DBE goal is shown on the cover of the bidding proposal. The contractor can meet the specified contract DBE goal by procuring services or materials from a DBE or by subcontracting work to a DBE. The department calculates the DBE participation as the dollar value of DBE participation included in the bid expressed as a percentage of the total contract bid amount.
- b. Under the contract, the contractor agrees to provide the assistance to participating DBE's in the following areas:
 - i. Produce accurate and complete quotes.
 - ii. Understand highway plans applicable to their work.
 - iii. Understand specifications and contract requirements applicable to their work.
 - iv. Understand contracting reporting requirements.
- c. The department encourages the contractor to assist and develop DBE firms to become fully knowledgeable contractors to successfully perform on its contracts.
- d. For information on the disadvantaged business program, visit the department's Civil Rights and Compliance Section website at:

<http://wisconsindot.gov/Pages/doing-bus/civil-rights/dbe/default.aspx>

2. Definitions

- a. Interpret these terms, used throughout this additional special provision, as follows:
 - i. **Bid Percentage:** The DBE percentage indicated in the bidding proposal at the time of bid.
 - ii. **DBE:** A disadvantaged business enterprise (DBE) certified as a DBE by the department and included on the department's list of certified DBE's who are determined to be ready, willing and able.
 - iii. **DBE goal:** The amount of DBE participation expected in the contract as shown on the cover of the Highway Work Proposal.
 - iv. **Discretionary Goal:** A contractor assigned DBE goal, typically abbreviated as "Disc" on the cover of the Highway Work Proposal, which is enforced as committed.
 - v. **Manufacturer:** A firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract.
 - vi. **Supplier:** A firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment required under the contract are bought, kept in stock, and regularly sold or leased to the public.
 - vii. **Voluntary Achievement:** The amount of DBE participation achieved and reported in the contract in excess of the assigned goal.

3. DBE Percentage Required at Bid Submission

Indicate the bid percentage (i.e. 0% through 100%) of DBE participation on the completed bidding proposal, including projects with discretionary goals. For electronic submittals, show the percentage in the miscellaneous data folder, Item 3, DBE Percent. For paper submittals, show the percentage on the sheet included after the schedule of items. By submission of the bid, the bidder contractually

commits to DBE participation at or above the bid percentage, or certifies that they have utilized comprehensive good faith efforts to solicit and utilize DBE firms to meet the DBE participation requirements of this contract proposal, and that the bid percentage is reflective of these good faith efforts. If the bidder does not indicate the bid percentage of DBE participation on the completed bidding proposal, the department will consider the bid irregular and may reject the bid.

4. Department's DBE Evaluation Process

a. Documentation Submittal

Within 10 business days after the notification of contract award, the contractor is to identify, by name, the DBE firms whose utilization is intended to satisfy this provision, the items of work of the DBE subcontract or supply agreement and the dollar value of those items of work by completing the Commitment to Subcontract to DBE Form [DT1506] and all necessary attachment A forms, as well as, Good Faith Waiver Form [DT1202] and supporting documentation as necessary. If the contractor fails to furnish the required forms within the specified time, the department may cancel the award. Delay in fulfilling this requirement is not a cause for extension of the contract time and shall not be used as a tool to delay execution.

i. Bidder Meets DBE Goal

If the bidder indicates that the contract DBE goal is met, after award and before execution, the department will evaluate the Commitment to Subcontract to DBE Form DT1506 and attachment A(s) to verify the actual DBE percentage achieved. If the DBE commitment is verified, the contract is eligible for execution with respect to the DBE commitment.

ii. Bidder Does Not Meet DBE Goal

- (1) If the bidder indicates a bid percentage on the Commitment to Subcontract to DBE Form [DT1506] that does not meet the contract DBE goal, the bidder must submit a Good Faith Waiver Form [DT1202] and supporting documentation. After award and before execution, the department will evaluate the bidder's DBE commitment and consider the bidder's good faith waiver request.
- (2) The department will review the bidder's good faith waiver request and notify the bidder of one of the following:
 - a. If the department grants a good faith waiver, the bid is eligible for contract execution with respect to DBE commitment.
 - b. If the department rejects the good faith waiver request, the department may declare the bid ineligible for execution. The department will provide a written explanation of why the good faith waiver request was rejected. The bidder may appeal the department's rejection as allowed under 7 a. & b.

5. Department's Criteria for Good Faith Effort

The Code of Federal Regulations {CFR}, 49 CFR Part 26-Appendix A, is the guiding regulation concerning good faith efforts. However, the federal regulations do not define "good faith" but states that bidder must actively and aggressively attempt to meet the goal. The federal regulations are general and do not include every factor or effort that can be considered. As a result, each state must establish its own processes and consider the factors established in its own process when making a determination of good faith.

- a. The department will only grant a good faith waiver if the bidder has made the effort, given the relevant circumstances under the contract that a bidder actively and aggressively seeking to meet the goal would make. The department will evaluate the bidder's good faith effort to determine whether a good faith waiver will be granted. The bidder must demonstrate, on the DT1202 that they

have aggressively solicited DBE participation in an attempt to meet the contract DBE goal and attaining the stated DBE goal is not feasible.

- b. The department, in conjunction with industry stakeholders, has developed the following guidance for contractor good faith effort. The guidance and the attached appendices provide a framework for the actions required by all parties in the processing and evaluation of bidder's total efforts to achieve the project specific DBE goal prior to the bid letting date.
- c. Prime Contractors should:
 - i. Document all efforts and decisions made toward achieving the DBE goal on the contract. The bidder should use the Civil Rights & Compliance System [CRCS] and related WisDOT-approved DBE outreach tools, including the Bid Express Small Business Network, to foster DBE participation on all applicable contracts.
 - ii. Request quotes by identifying potential items to subcontract and solicit. Prime contractors are strongly encouraged to include in their initial contacts a single page including a detailed list of items for which they are accepting quotes, by project, within a letting. *See attached sample entitled "Sample Contractor Solicitation Letter" in Appendix A.* Prime contractors should also indicate a willingness to accept quotes in areas they are planning to perform themselves, **as required by federal rules**. In some cases, it might be appropriate to use DBE's to do work in a prime contractor's area of specialization.
 - (1) Solicit quotes through all reasonable and available means from certified DBE firms who match 'possible items to subcontract' and send copies to DBESS office, highlighting areas in which you are seeking quotes. Email is acceptable.
 - (2) SBN is the preferred outreach tool. <https://www.bidx.com/wi/main> Other acceptable means include postal mail, email, fax, phone call.
 - a. Primes must ask DBE firms for a response in their solicitations. See *Sample Contractors Solicitation Letter* in Appendix. This letter can be included as an attachment to the SBN sub-quote request.
 - b. Solicit quotes at least 10 calendar days prior to the letting date {ideally two Fridays before the letting} to allow DBE firms sufficient time to respond. Prime contractors should contact DBE firms early, asking them if they need help in putting together a quote, or helping to arrange for equipment needs, or solve other problems.
 - (3) Second solicitation should take place within 5 days
 - a. An email solicitation is highly recommended for this second solicitation
 - (4) Upon request, provide interested DBE firms with adequate information about plans, specifications and the requirements of the contract by letter, information session, email, phone call and/or referral.
 - (5) When potential exists, advise interested DBE firms on how to obtain bonding, line of credit or insurance as may be requested.
 - (6) Document DBE firm's interest in quoting by taking appropriate steps to follow up initial solicitation with:
 - a. Email to all prospective DBE firms in relevant work areas
 - b. Phone call log to DBE firms who express interest via written response or call.
 - c. Fax/letter confirmation
 - d. Copy of the DBE quotes
 - e. Signed copy of Bid Express SBN Record of Subcontractor Outreach Effort.

- d. Evaluate DBE quotes as documentation is critical if the prime does not utilize the DBE firm's quote for any reason.
- i. Evaluate DBE firm's capability to perform 'possible items to subcontract' using legitimate reasons, including but not limited to, **a discussion with the DBE firm** regarding its capabilities prior to the bid letting. If lack of capacity is your reason for not utilizing the DBE quote, you are required to contact the DBE directly regarding their ability to perform the work indicated in the UCP directory as their work area [NAICS code]; only the work area and/or NAICS code listed in the UCP directory will be counted for DBE credit. Documentation of the conversation is required.
 - ii. In striving to meet a DBE conscious contract goal, prime contractors are expected to use DBE quotes that are responsive and reasonable. This includes DBE quotes that are not the low quote.
 - iii. **Special Circumstance:** Evaluation of DBE quotes with tied bid items. "Tied quotes are the condition in which a subcontractor submits quotes including multiple areas of expertise across multiple work areas noting that the items and price are tied. Typically this type of quoting represents a cost saving to the prime but is not clearly stated as a discount; tied quotes are usually presented as 'all or none' quote to the prime." When non-DBE subcontractors submit tied bid items in their quotes to the prime, the DBE firms' quote may seem not competitive. In such a case, the following steps are taken in comparing the relevant quotes. These are qualitative examples.
 - (1) Compare bid items common to both quotes, noting the reasonableness in the price comparison.
 - (2) Review quotes from other firms for the bid items not quoted by the DBE firm to see if combining both can provide the same competitive advantage that the tied bid items offered.
- e. After notification of contract award, submit '**Commitment to Subcontract**' form within the time period specified in the contract.
- i. Provide the following information along with department form DT1202:
 - (1) The names, addresses, e-mail addresses, telephone numbers of DBE's contacted. The dates of both initial and follow-up contact. A printed copy of SBN solicitation is acceptable.
 - (2) A description of information provided to the DBE's regarding the plans, specifications, and estimated quantities for portions of the work to be performed by that DBE.
 - (3) Photocopies or electronic copies of all written solicitations to DBE's.
 - (4) Documentation of each quote received from a DBE and, if rejected, the reason for that rejection.
 - (5) Bidder attendance at any pre-solicitation or pre-bid meetings the department held to inform DBE's of participation opportunities available on the project.
- f. The department's DBE Support Services Office is available by phone, email or in writing to request assistance in meeting the DBE goal:

DBE Support Services Office
6150 Fond du Lac Ave.
Milwaukee, WI 53218
Phone: 414-438-4583 / 608-266-6961
Fax: 414-438-5392
E-mail: DOTDBESupportServices@dot.wi.gov

6. Bidder's Appeal Process

- a. A bidder can appeal the department's decision to deny the bidder's good faith waiver request. The bidder must provide written documentation refuting the specific reasons for rejection as stated in the department's rejection notice. The bidder may meet in person with the department if so requested. Failure to appeal within 7 calendar days after receiving the department's written notice of rejection of a good faith waiver request under constitutes a forfeiture of the bidder's right of appeal. If the bidder does not appeal, the department may declare the bid ineligible for execution.
- b. The department will appoint a representative, who did not participate in the original determination, to assess the bidder's appeal. The department will issue a written decision within 7 calendar days after the bidder presents all written and oral testimony. In that written decision, the department will explain the basis for finding that the bidder did or did not meet the contract DBE goal or make an adequate good faith effort to meet the contract DBE goal. The department's decision is final. If the department finds that the bidder did not meet the contract DBE goal or did not make adequate efforts to meet the DBE goal, the department may declare the bid ineligible for execution.

7. Department's Criteria for DBE Participation

Department's DBE List

- a. The department maintains a DBE list on the department's website
<http://wisconsindot.gov/Documents/doing-bus/civil-rights/dbe/ucp-directory.xlsx>
- b. The DBE office is also available to assist at 414-438-4583 or 608-266-6961.

8. Counting DBE Participation

Assessing DBE Work

- a. The department will only count the DBE usage towards the contract DBE goal if the DBE firm is certified as a DBE by one of the unified certification program agencies. If a firm becomes DBE certified before entering into a subcontract, the department may consider that DBE usage towards the contract goal. The department only counts the value of the work a DBE actually performs towards the DBE goal. The department assesses the DBE work as follows:
- b. The department counts work performed by the DBE's own resources. The department includes the cost of materials and supplies the DBE obtains for the work. The department also includes the cost of equipment the DBE leases for the work. The department will not include the cost of materials, supplies, or equipment the DBE purchases or leases from the prime contractor or its affiliate, except the department will count non-project specific leases the DBE has in place before the work is advertised.
- c. The department counts fees and commissions the DBE charges for providing a bona fide professional, technical, consultant, or managerial services. The department also counts fees and commissions the DBE charges for providing bonds or insurance. The department will only count costs the engineer deems reasonable based on experience or prevailing market rates.
- d. If a DBE subcontracts work, the department counts the value of the subcontracted work only if the DBE's subcontractor is also a DBE.
- e. The contractor shall maintain records and may be required to furnish periodic reports documenting its performance under this item.
- f. It is the prime contractor's responsibility to determine the DBE's ability to perform the work with the use of the UCP directory.

9. Commercially Useful Function

- a. The department counts expenditures of a DBE toward the DBE goal only if the DBE is performing a commercially useful function on that contract.
- b. A DBE is performing a commercially useful function if the following conditions are met:
- c. For contract work, the DBE is responsible for executing a distinct portion of the contract work and it is carrying out its responsibilities by actually performing, managing, and supervising that work.
- d. For materials and supplies, the DBE is responsible for negotiating price, determining quality and quantity, ordering, and paying for those materials and supplies.

10. Trucking

All bidders are expected to adhere to the department's current trucking policy posted on the HCCI website

<http://wisconsindot.gov/Documents/doing-bus/civil-rights/dbe/trucking-utilization-policy.pdf>

11. Manufacturers and Suppliers

The department counts material and supplies a DBE provides under the contract. The department will give full credit toward the DBE goal if the DBE is a manufacturer of those materials or supplies. The department will give 60 percent credit toward the DBE goal if the DBE is merely a supplier of those materials or supplies. It is the bidder's responsibility to find out if the DBE is considered a supplier or a manufacturer before listing them on Commitment to Subcontract to DBE form DT1506.

12. DBE Prime

If the prime contractor is a DBE, the department will only count the work the contractor performs with its own forces, the work DBE subcontractors perform, and the work DBE suppliers or manufacturers perform.

13. Joint Venture

If a DBE performs as a participant in a joint venture, the department will only count that portion of the total dollar value of the contract equal to that portion of the work that the DBE performs with its own forces.

14. Mentor Protégé

- a. If a DBE performs as a participant in a mentor protégé agreement, the department will credit the portion of the work performed by the DBE protégé firm
- b. On every other project that the mentor protégé team identifies itself on.
- c. For no more than one half of the total contracted DBE goal on any WisDOT project.

15. DBE Replacement

In the event a Prime Contractor needs to replace a DBE firm originally listed on the approved DBE Commitment Form DT1506, the Prime Contractor must comply with the department's DBE Replacement Policy located on the DBE page on the following web site:

<http://wisconsindot.gov/Documents/doing-bus/civil-rights/dbe/policy-statement.pdf>

16. Changes to the approved DBE Commitment Form DT1506

If there are any changes to the approved Commitment to Subcontract to DBE Form DT1506, the prime contractor must submit a revised DBE Commitment Form DT1506 and relevant attachment A(s) to the DBE Programs Office within 5 business days.

17. Contract Modifications

When additional opportunity is available by contract modifications, the Prime Contractor shall utilize DBE Subcontractors that were committed to equal work items, in the original contract.

18. Payment

Costs for conforming to this Additional Special Provision (ASP) and any associated DBE requirements are incidental to the contract.

APPENDIX A
Sample Contractor Solicitation Letter Page 1
This sample is provided as a guide not a requirement

GFW SAMPLE MEMORANDUM

TO: DBE FIRMS
FROM: POTENTIAL PRIME CONTRACTOR OR MAJOR SUBCONTRACTOR
SUBJECT: REQUEST FOR DBE QUOTES
LET DATE & TIME
DATE: MONTH DAY YEAR
CC: DBE OFFICE ENGINEER

Our company is considering bidding on the projects indicated on the next page, as a prime and/or a subcontractor for the Wisconsin Department of Transportation Month- date -year Letting. Page 2 lists the projects and work items that we may subcontract for this letting. We are interested in obtaining subcontractor quotes for these projects and work categories. Also note that we are willing to accept quotes in areas we may be planning to perform ourselves as required by federal rules.

Please review page 2, respond whether you plan to quote, highlight the projects and work items you are interested in performing and return it via fax or email within 3 days. Plans, specifications and addenda are available through WisDOT at the DBE Support Services office or at the Highway Construction Contract Information (HCCI) site at <http://roadwaystandards.dot.wi.gov/hcci/>

Your quote should include all of the costs required to complete the items you propose to perform including labor, equipment, material, and related bonding or insurance. The quote should note items that you are DBE certified to perform, tied items, and any special terms. Page 2, with the indicated projects and items you plan to quote, should be used as a cover sheet for your quote.

Please make every effort to have your quotes into our office by time deadline the prior to the letting date. **Make sure the correct letting date, project ID and proposal number, unit price and extension are included in your quote.** We prefer quotes be sent via SBN but prime's alternative's are acceptable. Our office hours are include hours and days. Please call our office as soon as possible prior to the letting if you need information/clarification to prepare your quote at contact number.

If you wish to discuss or evaluate your quote in more detail, contact us after the contract is awarded. Status of the contract can be checked at WisDOT's HCCI site at <http://roadwaystandards.dot.wi.gov/hcci/>

All questions should be directed to:

Project Manager, John Doe,
Phone: (000) 123-4567
Email: Joe@joetheplumber.com
Fax: (000) 123- 4657

Sample Contractor Solicitation Letter Page 2

This sample is provided as a guide not a requirement

REQUEST FOR QUOTATION

Prime's Name: _____

Letting Date: _____

Project ID: _____

Please check all that apply

- ☐ Yes, we will be quoting on the projects and items listed below
- ☐ No, we are not interested in quoting on the letting or its items referenced below
- ☐ Please take our name off your monthly DBE contact list
- ☐ We have questions about quoting this letting. Please have some one contact me at this number

Prime Contractor's Contact Person

Phone: _____
Fax: _____
Email: _____

DBE Contractor Contact Person

Phone: _____
Fax: _____
Email: _____

Please circle the jobs and items you will be quoting below

Proposal No.	1	2	3	4	5	6	7
County							

WORK DESCRIPTION:

Clear and Grub	X		X	X		X	X
Dump Truck Hauling	X		X	X		X	X
Curb & Gutter/Sidewalk, Etc.	X		X	X		X	X
Erosion Control Items	X		X	X		X	X
Signs and Posts/Markers	X		X	X		X	X
Traffic Control		X	X	X		X	X
Electrical Work/Traffic Signals		X	X	X		X	
Pavement Marking		X	X	X	X	X	X
Sawing Pavement		X	X	X	X	X	X
QMP, Base	X	X		X	X	X	X
Pipe Underdrain	X			X			
Beam Guard				X	X	X	X
Concrete Staining							X
Trees/Shrubs	X						X

Again please make every effort to have your quotes into our office by time deadline prior to the letting date.

We prefer quotes be sent via SBN but prime's preferred alternative's are acceptable.

If there are further questions please direct them to the prime contractor's contact person at phone number.

APPENDIX B BEST PRACTICES FOR PRIME CONTRACTOR & DBE SUBCONTRACTOR GOOD FAITH EFFORT

This list is not a set of requirements; it is a list of potential strategies

Primes

- Prime contractor open houses inviting DBE firms to see the bid “war room” or providing technical assistance
- Participate in speed networking and mosaic exercises as arranged by DBE office
- Host information sessions not directly associated with a bid letting;
- Participate in a formal mentor protégé or joint venture with a DBE firm
- Participate in WisDOT advisory committees i.e. TRANSAC, or Mega Project committee meetings
- Facilitate a small group DBE ‘training session’ Clarifying how your firm prepares for bid letting, evaluates subcontractors, preferred qualifications and communication methods
- Encourage subcontractors to solicit and highlight DBE participation in their quotes to you
- Quality of communication, not quantity creates the best results. Contractors should do as thorough a job as possible in communicating with DBE firms before the bid and provide any assistance requested to assure best possible bid.

DBE

- DBE firms should contact primes as soon as possible with questions regarding their quotes or bid; seven days prior is optimal.
- Continually check for contract addendums on the HCCI website through the Thursday prior to letting to stay abreast of changes.
- Review the status of contracts on the HCCI website reviewing the ‘apparent low bidder’ list, and bid tabs at a minimum.
- Prepare a portfolio or list of related projects and prime and supplier references; be sure to note transportation-related projects of similar size and scope, firm expertise and staffing.
- Participate in DBE office assessment programs
- Participate on advisory and mega-project committees
- Sign up to receive the DBE Contracting Update
- Consider membership in relevant industry or contractor organizations
- Active participation is a must. Quote as many projects as you can reasonably work on; quoting the primes and bidding as a prime with the department are the only ways to get work.

APPENDIX C

Types of Efforts considered in determining GFE

This list represents concepts being assessed; analysis requires additional steps

1. Whether the contractor attended any pre-solicitation or pre-bid meetings that were scheduled by WisDOT to inform DBEs of contracting and subcontracting opportunities;
2. Whether the contractor provided written notice to a reasonable number of specific DBEs that their interest in the contract was being solicited, in sufficient time to allow the DBEs to participate effectively;
3. Whether the contractor followed up initial solicitations of interest by contacting DBEs to determine if the DBEs were interested; returned the phone calls of interested DBE firms.
4. Whether the contractor selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the DBE goal;
5. Whether the contractor provided interested DBEs with adequate information about the plans, specifications and requirements of the contract;
6. Whether the contractor negotiated in good faith with interested DBEs, not rejected DBEs as unqualified without sound reasons based on a thorough investigation of their capabilities;
7. Whether the contractor made efforts to assist interested DBEs in being more competitive.
8. Whether the contractor effectively used the services of available minority community organizations: minority contractors groups, local, state, and Federal minority business assistance offices, and other organizations that provide assistance to small businesses and DBE firms.
9. Whether Prime used CRCS to identify DBE who specialize in relevant work areas.
10. Whether the contractor used available resources including contacting the DBE office, using WisDOT's website
11. Whether the contractor returned calls of firms expressing interest in a timely manner.

APPENDIX D
Good Faith Effort Evaluation Guidance
Excerpt from Appendix A of 49 CFR Part 26

APPENDIX A TO PART 26 -- GUIDANCE CONCERNING GOOD FAITH EFFORTS

- I. When, as a recipient, you establish a contract goal on a DOT assisted contract, a bidder must, in order to be responsible and/or responsive, make good faith efforts to meet the goal. The bidder can meet this requirement in either of two ways. First, the bidder can meet the goal, documenting commitments for participation by DBE firms sufficient for this purpose. Second, even if it doesn't meet the goal, the bidder can document adequate good faith efforts. This means that the bidder must show that it took all necessary and reasonable steps to achieve a DBE goal or other requirement of this part which, by their scope, intensity, and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not fully successful.
- II. In any situation in which you have established a contract goal, part 26 requires you to use the good faith efforts mechanism of this part. As a recipient, it is up to you to make a fair and reasonable judgment whether a bidder that did not meet the goal made adequate good faith efforts. It is important for you to consider the quality, quantity, and intensity of the different kinds of efforts that the bidder has made. The efforts employed by the bidder should be those that one could reasonably expect a bidder to take if the bidder were actively and aggressively trying to obtain DBE participation sufficient to meet the DBE contract goal. Mere pro forma efforts are not good faith efforts to meet the DBE contract requirements. We emphasize, however, that your determination concerning the sufficiency of the firm's good faith efforts is a judgment call: meeting quantitative formulas is not required.
- III. The Department also strongly cautions you against requiring that a bidder meet a contract goal (i.e., obtain a specified amount of DBE participation) in order to be awarded a contract, even though the bidder makes an adequate good faith efforts showing. This rule specifically prohibits you from ignoring bona fide good faith efforts.
- IV. The following is a list of types of actions which you should consider as part of the bidder's good faith efforts to obtain DBE participation. It is not intended to be a mandatory checklist, nor is it intended to be exclusive or exhaustive. Other factors or types of efforts may be relevant in appropriate cases.
 - A. Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBEs who have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBEs to respond to the solicitation. The bidder must determine with certainty if the DBEs are interested by taking appropriate steps to follow up initial solicitations.
 - B. Selecting portions of the work to be performed by DBEs in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the prime contractor might otherwise prefer to perform these work items with its own forces.
 - C. Providing interested DBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

- D.
 - (1) Negotiating in good faith with interested DBEs. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBEs to perform the work.
 - (2) A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBEs is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also, the ability or desire of a prime contractor to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Prime contractors are not, however, required to accept higher quotes from DBEs if the price difference is excessive or unreasonable.
 - E. Not rejecting DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. The contractor's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non solicitation of bids in the contractor's efforts to meet the project goal.
 - F. Making efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance as required by the recipient or contractor.
 - G. Making efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services.
 - H. Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and Federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBEs.
- V. In determining whether a bidder has made good faith efforts, you may take into account the performance of other bidders in meeting the contract. For example, when the apparent successful bidder fails to meet the contract goal, but others meet it, you may reasonably raise the question of whether, with additional reasonable efforts, the apparent successful bidder could have met the goal. If the apparent successful bidder fails to meet the goal, but meets or exceeds the average DBE participation obtained by other bidders, you may view this, in conjunction with other factors, as evidence of the apparent successful bidder having made good faith efforts.

Appendix E

Small Business Network [SBN] Overview

The Small Business Network is a part of the Bid Express® service that was created to ensure that prime bidders have a centralized online location to find subs - including small and disadvantaged business enterprises (DBEs). It is available for prime bidders to use as part of their Basic Service subscription. Within the Small Business Network, **Prime Contractors** can:

1. Easily select proposals, work types and items:
 - a. After adding applicable work types, select items that you wish to quote. Enter the sub-quote quantities and add comments, if desired. Adding or removing items and work types can be done quickly. If needed, you can save the sub-quote for completion at a later time.
2. Create sub-quotes for the subcontracting community:
 - a. Create sub-quotes with ease using the intuitive sub-quote creator. In seven short steps, you can rapidly create a custom sub-quote directed to all subcontractors that bid on the applicable work types. Steps include: provide contact information and sub-quote expiration date, select letting and proposal, add work types and items, specify terms and conditions, upload attachments, and select vendors.
 - b. Create a sub-quote to send to subcontractors or suppliers that lists the items in a proposal that you want quoted
 - c. Create an unlimited number of sub-quotes for items you want quoted, and optionally mark them as a DBE-preferred request
 - d. Add attachments to sub-quotes
3. View sub-quote requests & responses:
 - a. After logging into the Bid Express service, you can quickly review all of your sub-quote requests and all unsolicited sub-quote requests from subcontractors. To simplify the Small Business Network home screen, sub-quote requests can be hidden with one click if they are not applicable.
 - b. View or receive unsolicited sub-quotes that subcontractors have posted, complete with terms, conditions and pricing
4. View Record of Subcontractor Outreach Effort:
 - a. For each sub-quote produced, a *Record of Subcontractor Outreach Effort* is generated that shows the response statistics for a particular sub-quote. If accepted by the letting agency, this report may serve as proof of a “Good Faith” effort in reaching out to the DBE community.
 - b. Easily locate pre-qualified and certified small and disadvantaged businesses
 - c. Advertise to small and disadvantaged businesses more efficiently and cost effectively
 - d. Document your interactions with subs/DBEs by producing an Outreach Report (may be accepted as proof of DBE outreach at the discretion of each agency)

The Small Business Network is a part of the Bid Express® service that was created to ensure that small businesses have a centralized area to access information about upcoming projects. It can help small businesses learn more about opportunities, compete more effectively, network with other contractors and subcontractors, and win more jobs.

1. View and reply to sub-quote requests from primes:
 - a. After logging into the Bid Express service, you can quickly review all incoming sub-quote requests and all unsolicited sub-quotes created by your company. Receive notifications by selected work type. To simplify on the Small Business Network home screen, sub-quote requests can be filtered by work types relevant to your interests, or hidden with one click if they are not applicable.
2. Select items when responding to sub-quote requests from primes:
 - a. You have the freedom to choose and price any number of items when responding to a sub-quote request. Quantities can be modified, and per-item comments are also available.
 - b. View requests for sub-quotes for work that primes have posted for projects they are bidding, add your pricing, terms, and conditions, and submit completed sub-quotes to the requesting primes
 - c. Add attachments to a sub-quote
3. Create and send unsolicited sub-quotes to specific contractors:
 - a. Create unsolicited sub-quotes with ease using the intuitive sub-quote creator. In eight short steps, you can rapidly create a custom sub-quote directed at any number of specific vendors of your choosing. Steps include: provide contact information and sub-quote expiration date, select letting and proposal, add work types and items, specify terms and conditions, upload attachments, and select vendors.
4. Easily select and price items for unsolicited sub-quotes:
 - a. After adding applicable work types, select items that you wish to quote. The extended price calculates automatically, cutting out costly calculation errors. Comments can be provided on an per-item basis as well.
 - b. Create an unsolicited sub-quote that lists the items from a proposal that you want to quote, include pricing, terms and conditions, and send it to selected prime/plan holder
 - c. Add attachments to a sub-quote
 - d. Add unsolicited work items to sub-quotes that you are responding to
5. Easy Access to Valuable Information
 - a. Receive a confirmation that your sub-quote was opened by a prime
 - b. View Bid Tab Analysis data from past bids, including the high, average and low prices of items.
 - c. View important notices and publications from DOT targeted to small and disadvantaged businesses
6. Accessing Small Business Network for WisDOT contracting opportunities
 - a. If you are a contractor not yet subscribing to the Bid Express service, go to **www.bidx.com** and select “Order Bid Express.” The Small Business Network is a part of the Bid Express Basic Service.
 - b. DBE firms can request a Bid Express Small Business Network Account at no cost by calling 414-438-4588

ADDITIONAL SPECIAL PROVISION 4

Payment to First-Tier Subcontractors

Within 10 calendar days of receiving a progress payment for work completed by a subcontractor, pay the subcontractor for that work. The prime contractor may withhold payment to a subcontractor if, within 10 calendar days of receipt of that progress payment, the prime contractor provides written notification to the subcontractor and the department documenting "just cause" for withholding payment.

The prime contractor may also withhold routine retainage from payments due subcontractors.

Payment to Lower-Tier Subcontractors

Ensure that subcontracting agreements at all tiers provide prompt payment rights to lower-tier subcontractors that parallel those granted first-tier subcontractors in this provision.

Release of Routine Retainage

After granting substantial completion the department may reduce the routine retainage withheld from the prime contractor to 75 percent of the original total amount retained.

When the Department sends the semi-final estimate the department may reduce the routine retainage withheld from the prime contractor to 10 percent of the original total amount retained.

Within 30 calendar days of receiving the semi-final estimate from the department, submit written certification that subcontractors at all tiers are paid in full for acceptably completed work and that no routine retainage is being withheld. The department will pay the prime contractor in full and reduce the routine retainage withheld from the prime contractor to zero when the department approves the final estimate.

This special provision does not limit the right of the department, prime contractor, or subcontractors at any tier to withhold payment for work not acceptably completed or work subject to an unresolved contract dispute.

ADDITIONAL SPECIAL PROVISIONS 5**Fuel Cost Adjustment****A Description**

Fuel Cost Adjustments will be applied to partial and final payments for work items categorized in Section B as a payment to the contractor or a credit to the department. ASP-5 shall not apply to any force account work.

B Categories of Work Items

The following items and Fuel Usage Factors shall be used to determine Fuel Cost Adjustments:

(1) Earthwork.		Unit	Gal. Fuel Per Unit
205.0100	Excavation Common	CY	0.23
205.0200	Excavation Rock	CY	0.39
205.0400	Excavation Marsh	CY	0.29
208.0100	Borrow	CY	0.23
208.1100	Select Borrow	CY	0.23
209.0100	Backfill Granular	CY	0.23
350.0102	Subbase	CY	0.28
350.0104	Subbase	Ton	0.14
350.0115	Subbase 6-Inch	SY	0.05
350.0120	Subbase 7-Inch	SY	0.05
350.0125	Subbase 8-Inch	SY	0.06
350.0130	Subbase 9-Inch	SY	0.07
350.0135	Subbase 10-Inch	SY	0.08
350.0140	Subbase 11-Inch	SY	0.09
350.0145	Subbase 12-Inch	SY	0.09

C Fuel Index

A Current Fuel Index (CFI) in dollars per gallon will be established by the Department of Transportation for each month. The CFI will be the price of No. 2 fuel oil, as reported in U.S. Oil Week, using the first issue dated that month. The CFI will be the average of prices quoted for Green Bay, Madison, Milwaukee and Minneapolis.

The base Fuel Index (BFI) for this contract is \$1.10 per gallon.

D Computing the Fuel Cost Adjustment

The engineer will compute the ratio CFI/BFI each month. If the ratio falls between 0.85 and 1.15, inclusive, no fuel adjustment will be made for that month. If the ratio is less than 0.85 a credit to the department will be computed. If the ratio is greater than 1.15 additional payment to the contractor will be computed. Credit or additional payment will be computed as follows:

- (1) The engineer will estimate the quantity of work done in that month under each of the contract items categorized in Section B.
- (2) The engineer will compute the gallons of fuel used in that month for each of the contract items categorized in Section B by applying the unit fuel usage factors shown in Section B.
- (3) The engineer will summarize the total gallons (Q) of fuel used in that month for the items categorized in Section B.
- (4) The engineer will determine the Fuel Cost Adjustment credit or payment from the following formula:

$$FA = \left(\frac{CFI}{BFI} - 1 \right) \times Q \times BFI$$

(plus is payment to contractor; minus is credit to the department)

Where	FA	=	Fuel Cost Adjustment (plus or minus)
	CFI	=	Current Fuel Index
	BFI	=	Base Fuel Index
	Q	=	Monthly total gallons of fuel

E Payment

A Fuel Cost Adjustment credit to the department will be deducted as a dollar amount each month from any sums due to the contractor. A Fuel Cost Adjustment payment to the contractor will be made as a dollar amount each month.

Upon completion of the work under the contract, any difference between the estimated quantities and the final quantities will be determined. An average CFI, calculated by averaging the CFI for all months that fuel cost adjustment was applied, will be applied to the quantity differences. The average CFI shall be applied in accordance with the procedure set forth in Section D.

ADDITIONAL SPECIAL PROVISION 6**ASP 6 - Modifications to the standard specifications**

Make the following revisions to the standard specifications:

450.3.2.1 General

Replace the entire text with the following effective with the June 2016 letting:

450.3.2.1.1 Preparation and Paving Operations

- (1) Do not place asphaltic mixture when the air temperature approximately 3 feet above grade, in shade, and away from artificial heat sources is less than 36 F for upper layers or 32 F for lower layers unless the engineer allows in writing. The contractor should place HMA pavement for projects in the northern asphalt zone between May 1 and October 15 inclusive and for projects in the southern asphalt zone between April 15 and November 1 inclusive. CMM 4-53 figure 2 defines asphalt zones. Notify the engineer at least one business day before paving.
- (2) Unless the contract specifies otherwise, conform to the following:
 - Keep the road open to all traffic during construction.
 - Prepare the existing foundation for treatment as specified in 211.
 - Incorporate loose roadbed aggregate as a part of preparing the foundation, in shoulder construction, or dispose of as the engineer approves.
- (3) Place asphaltic mixture only on a prepared, firm, and compacted base, foundation layer, or existing pavement substantially surface-dry and free of loose and foreign material. Do not place over frozen subgrade or base, or where the roadbed is unstable.

450.3.2.1.2 Cold Weather Paving**450.3.2.1.2.1 General**

- (1) Conform to these cold weather paving provisions for work performed under the following:
 - The 460 HMA Pavement bid items.
 - The 465 Asphaltic Surface bid items.
 - Special provisions that require placing mixture conforming to the contract requirements under 460 for HMA pavement or under 465 for asphaltic surface.

450.3.2.1.2.2 Cold Weather Paving Plan

- (1) Submit a written cold weather paving plan to the engineer at the preconstruction meeting. In that plan outline material, operational, and equipment changes for paving when the air temperature approximately 3 feet above grade, in shade, and away from artificial heat sources is less than 40 F. Include the following:
 - Use a department-accepted HMA mix design that incorporates a warm mix additive from the department's approved products list. Do not use a foaming process that introduces water into the mix.
 - Identify the warm mix additive and dosage rate.
 - Identify modifications to the compaction process and when to use them.
- (2) Engineer written acceptance is required for the cold weather paving plan. Engineer acceptance of the plan does not relieve the contractor of responsibility for the quality of HMA pavement placed in cold weather except as specified in 450.5.2(3).

450.3.2.1.2.3 Cold Weather Paving Operations

- (1) Do not place asphaltic mixture when the air temperature approximately 3 feet above grade, in shade, and away from artificial heat sources is less than 40 F unless a valid engineer-accepted cold weather paving plan is in effect.
- (2) If the national weather service forecast for the construction area predicts ambient air temperature less than 40 F at the projected time of paving within the next 24 hours, confirm or submit revisions to the cold weather paving plan for engineer validation. Update the plan as required to accommodate the conditions anticipated for the next day's operations. Upon validation of the plan, the engineer will allow paving for the next day. Once in effect, pave conforming to the engineer-accepted cold weather paving plan for the balance of that work day or shift regardless of the temperature at the time of paving.

450.4 Measurement

Add the following as paragraph three effective with the June 2016 letting:

- (3) The department will measure HMA Cold Weather Paving by the ton of HMA mixture placed conforming to an engineer-accepted cold weather paving plan.

450.5 Payment

Replace the entire text with the following effective with the June 2016 letting:

450.5.1 General

- (1) All costs of furnishing, maintaining, and operating the truck scale or other weighing equipment and furnishing the weigh tickets are incidental to the contract.
- (2) Nonconforming material allowed to remain in place is subject to price adjustment under 105.3.2.
- (3) Full-depth sawing to remove integrally placed safety edge where not required is incidental to the contract.
- (4) The contractor is responsible for the quality of HMA placed in cold weather.

450.5.2 Cold Weather Paving

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

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
450.4000	HMA Cold Weather Paving	TON

- (2) Payment for HMA Cold Weather Paving is full compensation for additional materials and equipment specified for cold weather paving under 450.3.2.1.2 including costs for preparing, administering, and following the contractor's cold weather paving plan. The department will not pay for HMA Cold Weather Paving for HMA placed as follows:
- If the lot density is less than the minimum specified in table 460-3 for mixture placed under 460.
 - On days when the department is assessing liquidated damages.
- (3) If because of an excusable compensable delay under 108.10.3, the engineer directs the contractor to pave when the temperature is less than 36 F for the upper layer or less than 32 F for lower layers, the department:
- Will relieve the contractor of responsibility for damage and defects the engineer attributes to cold weather paving.
 - Will not assess disincentives for density or ride.
- (4) If HMA pavement is placed under 450.3.2.1.2 and the HMA Cold Weather Paving bid item is not in the contract, the department will pay for the additional costs specified in 450.5.2(2) as extra work. The department will pay separately for providing HMA pavement and HMA surface under 460.5, 465.5, and the contract special provisions.

460.3.4 Cold Weather Paving

Delete the entire subsection effective with the June 2016 letting:

460.5.1 General

Replace the entire text with the following effective with the June 2016 letting:

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

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
460.5000 - 5999	HMA Pavement (gradation) LT (binder)(designation)	TON
460.6000 - 6999	HMA Pavement (gradation) MT (binder)(designation)	TON
460.7000 - 7999	HMA Pavement (gradation) HT (binder)(designation)	TON
460.8000 - 8999	HMA Pavement (gradation) SMA (binder)(designation)	TON
460.2000	Incentive Density HMA Pavement	DOL

460.5.2.2 Disincentive for HMA Pavement Density

Replace paragraph two with the following effective with the June 2016 letting:

- (2) The department will not assess density disincentives for pavement placed in cold weather because of a department-caused delay as specified in 450.5.2(3).

460.5.2.4 Cold Weather Paving

Delete the entire subsection effective with the June 2016 letting:

501.2.6 Fly Ash

Replace paragraph one with the following effective with the July 2016 letting:

- (4) Use only one source of fly ash for a bid item of work under the contract, unless the engineer directs or allows otherwise in writing.

550.5.2 Piling

Add the following as paragraph three effective with the December 2015 letting:

- (3) The department will not entertain a change order request for a differing site condition under 104.2.2.2 or for a quantity change under 104.2.2.4.3 for the Piling bid items. Instead the department will adjust pay under the Piling Quantity Variation administrative item if the total driven length of each size is less than 85 percent of, or more than 115 percent of the contract quantity as follows:

Percent of Contract Length Driven	Pay Adjustment
< 85	(85% contract length - driven length) x 20% unit price
> 115	(driven length - 115% contract length) x 5% unit price

643.2.1 General

Replace paragraph two with the following effective with the December 2015 letting:

- (2) Use reflective sheeting from the department's approved products list on barricades, drums, and flexible tubular marker posts.

715.3.1.2.1 General

Replace paragraph one with the following effective with the July 2016 letting:

- (1) Designate the location and size of all lots before placing concrete. Ensure that no lot contains concrete of more than one mix design or placement method defined within 715.3.1.2 as follows:

Mix design change A modification to the mix requiring the engineer's approval under 710.4(5).

For paving mixes, a source change under item 1 of 710.4(5) for fly ash of the same class that does not require a modification under items 2 through 4 of 710.4(5) does not constitute a mix design change.

Placement method Either slip-formed, not slip-formed, or placed under water.

Errata

Make the following corrections to the standard specifications:

460.2.7 HMA Mixture Design - TABLE 460-2 MIXTURE REQUIREMENTS

Correct errata in the Fractured Faces row of table 460-2 to reference ASTM D5821.

Fractured Faces (ASTM D5821) (one face/2 face, % by count)	60 / __	65 / __	75 / 60	85 / 80	98 / 90	100/100	100/90

Correct errata in footnote two of table 460-2 to reference AASHTO M323.

^[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.

641.2.9 Overhead Sign Supports

Correct errata adding back accidentally deleted paragraphs one through three.

- (1) Provide commercially fabricated overhead sign supports conforming to AASHTO design and fabrication standards for structural supports for highway signs, luminaires, and traffic signals. Use a design life of 50 years with a wind importance factor of 1.00. Design to withstand a 3 second gust wind speed of 90 mph. Do not use the methods of appendix C of those AASHTO standards.
- (2) Design structures, listed as applicable structure types in the AASHTO standards, to the fatigue category criteria as follows:
 1. Structures carrying variable message signs:
 - Category I criteria for structures over all roadway types.
 2. Structures carrying type II or III signs:
 - Category I criteria for structures used over highways and free flow ramps.
 - Category II criteria for structures with arms greater than 30 feet used over local roads and city streets.
 - Category III criteria for structures with arms 30 feet or less used over local roads and city streets.
- (3) Use the posted speed limit of the roadway beneath the structure for truck-induced gusts.
- (4) Submit shop drawings identified by structure number, design computations, and material specifications, to the engineer before erecting sign supports. Provide tightening procedures for mast arm or luminaire arm to pole shaft connections on the shop drawings. Have a professional engineer registered in the state of Wisconsin sign, seal, and date the shop drawings and certify that the design conforms to AASHTO standards and the contract.
- (5) Provide steel pole shafts and mast arms zinc coated according to ASTM A123. Provide tapered pole and arm shafts with a minimum taper of 0.14 inch per foot for single-member vertical and single-member horizontal structure components. Provide bolts and other hardware conforming to 641.2.2.

ADDITIONAL SPECIAL PROVISION 7

- A. Reporting 1st Tier and DBE Payments During Construction
1. Comply with reporting requirements specified in the department's Civil Rights Compliance, Contractor's User Manual, Sublets and Payments.
 2. Report payments to all DBE firms within 10 calendar days of receipt of a progress payment by the department or a contractor for work performed, materials furnished, or materials stockpiled by a DBE firm. Report the payment as specified in A(1) for all work satisfactorily performed and for all materials furnished or stockpiled.
 3. Report payments to all first tier subcontractor relationships within 10 calendar days of receipt of a progress payment by the department for work performed. Report the payment as specified in A(1) for all work satisfactorily performed.
 4. All tiers shall report payments as necessary to comply with the DBE payment requirement as specified in A(2).
 5. Require all first tier relationships, DBE firms and all other tier relationships necessary to comply with the DBE payment requirement in receipt of a progress payment by contractor to acknowledge receipt of payment as specified in A(1), (2), (3) and (4).
 6. All agreements made by a contractor shall include the provisions in A(1), (2), (3), (4) and (5), and shall be binding on all first tier subcontractor relationships and all contractors and subcontractors utilizing DBE firms on the project.
- B. Costs for conforming to this special provision are incidental to the contract.

ADDITIONAL SPECIAL PROVISION 9

Electronic Certified Payroll Submittal

(1) Use the department's Civil Rights Compliance System (CRCS) to submit certified payrolls electronically. Details are available online through the department's highway construction contractor information (HCCI) site on the Labor, Wages, and EEO Information page at:

<http://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/default.aspx>

(2) Ensure that all tiers of subcontractors, as well as all trucking firms, submit their weekly certified payrolls electronically through CRCS. These payrolls are due within seven calendar days following the close of the payroll period. Every firm providing physical labor towards completing the project is a subcontractor under this special provision.

(3) Upon receipt of contract execution, promptly make all affected firms aware of the requirements under this special provision and arrange for them to receive CRCS training as they are about to begin payrolls. The department will provide training either in a classroom setting at one of our regional offices or by telephone. Contact Tess Mulrooney at 608-267-4489 to schedule the training.

(4) The department will reject all paper submittals of forms DT-1816 and DT-1929 for information required under this special provision. All costs for conforming to this special provision are incidental to the contract.

(5) Firms wishing to export payroll data from their computer system into CRCS should have their payroll coordinator send several sample electronic files to Tess two months before a payroll needs to be submitted. Not every contractor's payroll system is capable of producing export files. For details, see pages 17-22 of the CRCS System Background Information manual available online on the Labor, Wages, and EEO Information page at:

<http://wisconsindot.gov/Documents/doing-bus/civil-rights/labornwage/crcs-payroll-manual.pdf>

REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under

this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are

applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar

with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#). The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor

will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions

of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or

will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program. Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-

Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly

rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is

evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.

2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this

covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Participants:

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which

this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the

department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

**ATTACHMENT A - EMPLOYMENT AND MATERIALS
PREFERENCE FOR APPALACHIAN DEVELOPMENT
HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS
ROAD CONTRACTS**

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

SEPTEMBER 2002

**NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE
EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)**

1. The Offeror's or Bidder's attention is called to the "Employment Practices" and "Equal Opportunity Clause" set forth in the Required Contract Provisions, FHWA 1273.
2. The goals and timetables for minority and female participation expressed in percentage terms for the contractor's aggregate work force in each trade, on all construction work in the covered area, are as follows:

Goals for Minority Participation for Each Trade:

<u>County</u>	<u>%</u>	<u>County</u>	<u>%</u>	<u>County</u>	<u>%</u>
Adams	1.7	Iowa	1.7	Polk	2.2
Ashland	1.2	Iron	1.2	Portage	0.6
Barron	0.6	Jackson	0.6	Price	0.6
Bayfield	1.2	Jefferson	7.0	Racine	8.4
Brown	1.3	Juneau	0.6	Richland	1.7
Buffalo	0.6	Kenosha	3.0	Rock	3.1
Burnett	2.2	Kewaunee	1.0	Rusk	0.6
Calumet	0.9	La Crosse	0.9	St. Croix	2.9
Chippewa	0.5	Lafayette	0.5	Sauk	1.7
Clark	0.6	Langlade	0.6	Sawyer	0.6
Columbia	1.7	Lincoln	0.6	Shawano	1.0
Crawford	0.5	Manitowoc	1.0	Sheboygan	7.0
Dane	2.2	Marathon	0.6	Taylor	0.6
Dodge	7.0	Marinette	1.0	Trempealeau	0.6
Door	1.0	Marquette	1.7	Vernon	0.6
Douglas	1.0	Menominee	1.0	Vilas	0.6
Dunn	0.6	Milwaukee	8.0	Walworth	7.0
Eau Claire	0.5	Monroe	0.6	Washburn	0.6
Florence	1.0	Oconto	1.0	Washington	8.0
Fond du Lac	1.0	Oneida	0.6	Waukesha	8.0
Forest	1.0	Outagamie	0.9	Waupaca	1.0
Grant	0.5	Ozaukee	8.0	Waushara	1.0
Green	1.7	Pepin	0.6	Winnebago	0.9
Green Lake	1.0	Pierce	2.2	Wood	0.6

Goals for female participation for each trade: 6.9%

These goals are applicable to all the contractor's construction work, (whether or not it is federal or federally assisted), performed in the covered area. If the contractor performs construction work in the geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The contractor's compliance with the Executive Order and the Regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project for the sole purpose of meeting the contractor's goals shall be a violation of the contract, the Executive Order and the Regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within ten (10) working days of award of any construction subcontract in excess of \$10,000.00 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor, employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

As referred to in this section, the Director means:

Director
Office of Federal Contract Compliance Programs
Ruess Federal Plaza
310 W. Wisconsin Ave., Suite 1115
Milwaukee, WI 53202

The "Employer Identification Number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

4. As used in this notice, and in the contract resulting from solicitation, the "covered area" is the county(ies) in Wisconsin to which this proposal applies.

APRIL 2013

ADDITIONAL FEDERAL-AID PROVISIONS

NOTICE TO ALL BIDDERS

To report bid rigging activities call:

1-800-424-9071

The U.S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m., Eastern Time. Anyone with knowledge of possible bid rigging, bidding collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

Effective August 2015 letting

BUY AMERICA PROVISION

All steel and iron materials permanently incorporated in this project shall be domestic products and all manufacturing and coating processes for these materials from smelting forward in the manufacturing process must have occurred within the United States. Coating includes epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of a material subject to the requirements of Buy America. The exemption of this requirement is the minimal use of foreign materials if the total cost of such material permanently incorporated in the product does not exceed one-tenth of one percent (1/10 of 1%) of the total contract cost or \$2,500.00, whichever is greater. For purposes of this paragraph, the cost is that shown to be the value of the subject products as they are delivered to the project. The contractor shall take actions and provide documentation conforming to CMM 2-28.5 to ensure compliance with this "Buy America" provision.

<http://wisconsindot.gov/rdwy/cmm/cm-02-28.pdf>

Upon completion of the project certify to the engineer, in writing using department form WS4567, that all steel, iron, and coating processes for steel or iron incorporated into the contract work conform to these "Buy America" provisions. Attach a list of exemptions and their associated costs to the certification form. Department form WS4567 is available at:

<http://wisconsindot.gov/hcciDocs/contracting-info/ws4567.doc>

Cargo Preference Act Requirement

All Federal-aid projects shall comply with 46 CFR 381.7 (a) – (b) as follows:

(a) *Agreement Clauses*. “Use of United States-flag vessels:”

(1) Pursuant to Pub. L. 664 (43 U.S.C. 1241(b)) at least 50 percent of any equipment, materials or commodities procured, contracted for or otherwise obtained with funds granted, guaranteed, loaned, or advanced by the U.S. Government under this agreement, and which may be transported by ocean vessel, shall be transported on privately owned United States-flag commercial vessels, if available.

(2) Within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (a)(1) of this section shall be furnished to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.”

(b) *Contractor and Subcontractor Clauses*. “Use of United States-flag vessels: The contractor agrees—”

(1) To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.

(2) To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b) (1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.

(3) To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this contract.

Effective with September 2004 Letting

**WISCONSIN DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS AND TRANSPORTATION FACILITIES**

SUPPLEMENTAL REQUIRED CONTRACT PROVISIONS

- I. Wage Rates, Hours of labor and payment of Wages
- II. Payroll Requirements
- III. Postings at the Site of the Work
- IV. Affidavits
- V. Wage Rate Redistribution
- VI. Additional Classifications

I. WAGE RATES, HOURS OF LABOR AND PAYMENT OF WAGES

The schedule of "Minimum Wage Rates" attached hereto and made a part hereof furnishes the prevailing wage rates that have been determined pursuant to Section 103.50 of the Wisconsin Statutes. These wage rates are the minimum required to be paid to the various laborers, workers, mechanics and truck drivers employed by contractors and subcontractors on the construction work embraced by the contract and subject to prevailing hours and wages under Section 103.50, Stats. If necessary to employ laborers, workers, mechanics or truck drivers whose classification is not listed on the schedule, they shall be paid at rates conformable to those listed for similar classifications. Apprentices shall be paid at rates not less than those prescribed in their state indenture contracts.

While the wage rates shown are the minimum rates required by the contract to be paid during its life, this is not a representation that labor can be obtained at these rates. It is the responsibility of bidders to inform themselves as to the local labor conditions and prospective changes or adjustments of wage rates. No increase in the contract price shall be allowed or authorized on account of the payment of wage rates in excess of those listed herein.

Pursuant to Section 103.50 of the Wisconsin Statutes, the prevailing hours of labor have been determined to be up to 10 hours per day and 40 hours per calendar week Monday through Friday. If any laborer, worker, mechanic or truck driver is permitted or required to work more than the prevailing number of hours per day or per calendar week on this contract, they shall be paid for all hours in excess of the prevailing hours at a rate of at least one and one-half (1 1/2) times their hourly rate of pay. All work on Saturday, Sunday and the following holidays is to be paid at time and a half: (1) January 1, (2) the last Monday in May, (3) July 4, (4) the first Monday in September, (5) the fourth Thursday in November, (6) December 25, (7) the day before if January 1, July 4 or December 25 falls on a Saturday and (8) the day following if January 1, July 4 or December 25 falls on a Sunday.

All laborers, workers, mechanics and truck drivers shall be paid unconditionally not less often than once a week. Persons who own and operate their own trucks must receive the prevailing truck driver rate for the applicable type of truck (i.e. 2 axle, 3 or more axle, articulated, eculid or dumptor) he or she operates, plus an agreed upon amount for the use of his or her truck. Every owner-operator MUST be paid separately for their driving and for the use of their truck.

For those projects subject to the requirements of the Davis-Bacon Act, the Secretary of Labor will also have determined "Minimum Wage Rates" for work to be performed under the contract. These rates are, for all or most of the labor, worker, mechanic or truck driver classifications, identical to those established under Section 103.50 of the Wisconsin Statutes. In the event the rates are not identical, the higher of the two rates will govern.

II. PAYROLL REQUIREMENTS

All contractors and subcontractors must submit weekly Certified Payrolls and Compliance Statement verifying that all laborers, workers, mechanics and truck drivers working on the project have been paid the prevailing wage rates for all work performed under the contract required by Section 103.50 of the Wisconsin Statutes.

III. POSTINGS AT THE SITE OF THE WORK

In addition to the required postings furnished by the Department, the contractor shall post the following in at least one conspicuous place at the site of work:

- a. "NOTICE TO EMPLOYEES," which provides information required to be posted by the provisions of Section 103.50 of the Wisconsin Statutes.
- b. A copy of the State of Wisconsin Minimum Wages Rates. (Four pages.)
- c. A copy of the contractor's Equal Employment Opportunity Policy.
- d. On any project involving federal aid, in addition to the furnished postings, the contractor shall post a copy of the "Davis-Bacon Act, Minimum Wage Rates". (Three pages.)

IV. WAGE RATE REDISTRIBUTION

The amount specified as the hourly basic rate of pay and the amount(s) specified as the fringe benefit contribution(s), for all classes of laborers, workers, mechanics or truck drivers may be redistributed, when necessary, to conform to those specified in any applicable collective bargaining agreement, provided that both parties to such agreement

request and receive the approval for any such redistribution from both the Department of Transportation and the Department of Workforce Development prior to the implementation of such redistribution.

V. ADDITIONAL CLASSIFICATIONS

Any unlisted laborer or mechanic classification that is needed to perform work on this project, and is not included within the scope of any of the classifications listed in the application prevailing wage rate determination, may be added after award only if all of the following criteria have been met:

1. The affected employer(s) must make a written request to WisDOT Central Office to utilize the unlisted classification on this project.
2. The request must indicate the scope of the work to be performed by the unlisted classification and must indicate the proposed wage/fringe benefit package that the unlisted classification is to receive.
3. The work to be performed by the unlisted classification must not be performed by a classification that is included in the applicable prevailing wage rate determination.
4. The unlisted classification must be commonly employed in the area where the project is located.
5. The proposed wage/fringe benefit package must bear a reasonable relationship to those set forth in the applicable prevailing wage rate determination.
6. The request should be made prior to the actual performance of the work by the unlisted classification.
7. DWD must approve the use of the unlisted classification and the proposed wage/fringe benefit package. USDOL also must approve the use of the unlisted classification and the proposed wage/fringe benefit package on federal aid projects.
8. WisDOT and DWD may amend the proposed wage/fringe benefit package, as deemed necessary, and may set forth specific employment ratios and scope of work requirements in the approval document.

The approved wage/fringe benefit package shall be paid to all laborers, workers, mechanics or truck drivers performing work within the scope of that performed by the unlisted classification, from the first day on which such work is performed. In the event that work is performed by the unlisted classification prior to approval, the wage/fringe benefit package to be paid for such work must be in conformance with the wage/fringe

benefit package approved for such work. Under this arrangement a retroactive adjustment in wages and/or fringe benefits may be required to be made to the affected laborers, workers, mechanics or truck drivers by the affected employer(s).

**ANNUAL PREVAILING WAGE RATE DETERMINATION
FOR ALL STATE HIGHWAY PROJECTS
LA CROSSE COUNTY**

Compiled by the State of Wisconsin - Department of Workforce Development
for the Department of Transportation
Pursuant to s. 103.50, Stats.
Issued on May 1, 2016

CLASSIFICATION: Contractors are required to call the Department of Workforce Development if there are any questions regarding the proper trade or classification to be used for any worker on a public works project.

OVERTIME: Time and one-half must be paid for all hours worked over 10 hours per day and 40 hours per calendar week and for all hours worked on Saturday, Sunday and the following six (6) holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; the day before if January 1, July 4 or December 25 falls on a Saturday; the day following if January 1, July 4 or December 25 falls on a Sunday.

FUTURE INCREASE: If indicated for a specific trade or occupation, the full amount of such increase MUST be added to the "TOTAL" indicated for such trade or occupation on the date(s) such increase(s) becomes effective.

PREMIUM PAY: If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whenever such pay is applicable.

SUBJOURNEY: Wage rates may be available for some of the classifications indicated below. Any employer that desires to use any subjourney classification on a project MUST request the applicable wage rate from the Department of Workforce Development PRIOR to the date such classification is used on such project. Form ERD-10880 is available for this purpose and can be obtained by writing to the Department of Workforce Development, Equal Rights Division, P.O. Box 8928, Madison, WI 53708.

<u>TRADE OR OCCUPATION</u>	<u>HOURLY BASIC RATE OF PAY</u>	<u>HOURLY FRINGE BENEFITS</u>	<u>TOTAL</u>
	\$	\$	\$
Bricklayer, Blocklayer or Stonemason	31.55	18.52	50.07
Carpenter	33.02	17.12	50.14
Future Increase(s): Add \$1.42/hr on 6/1/2016. Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Cement Finisher	34.64	19.64	54.28
Future Increase(s): Add \$1.75 on 6/1/16. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.			
Electrician	31.21	18.96	50.17
Future Increase(s): Add \$1.15 on 6/1/16 Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Fence Erector	35.62	0.00	35.62
Ironworker	32.50	20.58	53.08
Line Constructor (Electrical)	38.59	27.20	65.79
Painter	29.87	18.79	48.66
Pavement Marking Operator	30.00	18.27	48.27
Piledriver	30.11	21.09	51.20
Roofer or Waterproofer	30.40	2.23	32.63
Teledata Technician or Installer	17.50	5.57	23.07
Tuckpointer, Caulker or Cleaner	31.12	18.69	49.81
Underwater Diver (Except on Great Lakes)	36.74	16.00	52.74

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	\$	\$	\$
Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	36.73	15.92	52.65
Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	32.65	16.12	48.77
Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	28.57	13.71	42.28
Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.53	13.09	39.62
Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.97	34.72

TRUCK DRIVERS

Single Axle or Two Axle	36.72	21.15	57.87
Three or More Axle	25.78	18.96	44.74
Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Articulated, Euclid, Dumptor, Off Road Material Hauler	30.82	21.85	52.67
Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017.			
Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .			
Pavement Marking Vehicle	23.82	17.72	41.54
Shadow or Pilot Vehicle	25.28	18.31	43.59
Truck Mechanic	25.28	18.31	43.59

LABORERS

General Laborer	30.67	15.65	46.32
Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017			
Premium Pay: Add \$.10/hr for topman, air tool operator, vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add \$.15/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add \$.20/hr for blaster and powderman; Add \$.25/hr for bottomman; Add \$.35/hr for line and grade specialist; Add \$.45/hr for pipelayer. DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).			
Asbestos Abatement Worker	24.92	15.12	40.04
Landscaper	30.67	15.65	46.32
Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017			
Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).			
Flagperson or Traffic Control Person	27.30	15.65	42.95
Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017			
Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.			

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	\$	\$	\$
Fiber Optic Laborer (Outside, Other Than Concrete Encased)	15.50	0.79	16.29
Railroad Track Laborer	17.50	2.18	19.68

HEAVY EQUIPMENT OPERATORS

Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Traveling Crane (Bridge Type).	38.27	21.85	60.12

Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017.

Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium.

See DOT'S website for details about the applicability of this night work premium at:

<http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx>.

Backhoe (Track Type) Having a Mfr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs., & Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver.	37.77	21.85	59.62

Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017.

Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium.

See DOT'S website for details about the applicability of this night work premium at:

<http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx>.

Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boatmen (NOT Performing Work on the Great Lakes); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type);	37.27	21.85	59.12

<u>TRADE OR OCCUPATION</u>	<u>HOURLY BASIC RATE OF PAY</u>	<u>HOURLY FRINGE BENEFITS</u>	<u>TOTAL</u>
	\$	\$	\$
Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A- Frames. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .			
Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .	37.01	21.85	58.86
Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .	37.27	21.85	59.12
Fiber Optic Cable Equipment.	18.00	0.00	18.00

**ANNUAL PREVAILING WAGE RATE DETERMINATION
FOR ALL STATE HIGHWAY PROJECTS
MONROE COUNTY**

Compiled by the State of Wisconsin - Department of Workforce Development
for the Department of Transportation
Pursuant to s. 103.50, Stats.
Issued on May 1, 2016

CLASSIFICATION: Contractors are required to call the Department of Workforce Development if there are any questions regarding the proper trade or classification to be used for any worker on a public works project.

OVERTIME: Time and one-half must be paid for all hours worked over 10 hours per day and 40 hours per calendar week and for all hours worked on Saturday, Sunday and the following six (6) holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; the day before if January 1, July 4 or December 25 falls on a Saturday; the day following if January 1, July 4 or December 25 falls on a Sunday.

FUTURE INCREASE: If indicated for a specific trade or occupation, the full amount of such increase MUST be added to the "TOTAL" indicated for such trade or occupation on the date(s) such increase(s) becomes effective.

PREMIUM PAY: If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whenever such pay is applicable.

SUBJOURNEY: Wage rates may be available for some of the classifications indicated below. Any employer that desires to use any subjourney classification on a project MUST request the applicable wage rate from the Department of Workforce Development PRIOR to the date such classification is used on such project. Form ERD-10880 is available for this purpose and can be obtained by writing to the Department of Workforce Development, Equal Rights Division, P.O. Box 8928, Madison, WI 53708.

<u>TRADE OR OCCUPATION</u>	<u>HOURLY BASIC RATE OF PAY</u>	<u>HOURLY FRINGE BENEFITS</u>	<u>TOTAL</u>
	\$	\$	\$
Bricklayer, Blocklayer or Stonemason	31.55	18.52	50.07
Carpenter	33.02	17.12	50.14
Future Increase(s): Add \$1.42/hr on 6/1/2016. Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Cement Finisher	34.64	19.64	54.28
Future Increase(s): Add \$1.75 on 6/1/16. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.			
Electrician	31.21	18.96	50.17
Future Increase(s): Add \$1.15 on 6/1/16 Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Fence Erector	35.62	0.00	35.62
Ironworker	32.50	20.58	53.08
Line Constructor (Electrical)	37.77	26.40	64.17
Painter	29.87	18.79	48.66
Pavement Marking Operator	30.00	19.02	49.02
Piledriver	30.11	21.09	51.20
Roofer or Waterproofer	30.40	2.23	32.63
Teledata Technician or Installer	17.50	5.57	23.07
Tuckpointer, Caulker or Cleaner	31.12	18.69	49.81
Underwater Diver (Except on Great Lakes)	36.74	16.00	52.74

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	\$	\$	\$
Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	36.73	15.92	52.65
Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	32.65	16.12	48.77
Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	28.57	13.71	42.28
Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.53	13.09	39.62
Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.97	34.72

TRUCK DRIVERS

Single Axle or Two Axle	36.72	21.15	57.87
Three or More Axle	25.78	18.96	44.74
Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Articulated, Euclid, Dumptor, Off Road Material Hauler	30.82	21.85	52.67
Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017.			
Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevailing-wage-compliance.aspx .			
Pavement Marking Vehicle	23.82	17.72	41.54
Shadow or Pilot Vehicle	25.28	18.31	43.59
Truck Mechanic	25.28	18.31	43.59

LABORERS

General Laborer	30.67	15.65	46.32
Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017			
Premium Pay: Add \$.10/hr for topman, air tool operator, vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add \$.15/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add \$.20/hr for blaster and powderman; Add \$.25/hr for bottomman; Add \$.35/hr for line and grade specialist; Add \$.45/hr for pipelayer. DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).			
Asbestos Abatement Worker	24.92	15.12	40.04
Landscaper	30.67	15.65	46.32
Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017			
Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).			
Flagperson or Traffic Control Person	27.30	15.65	42.95
Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017			
Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.			

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	\$	\$	\$
Fiber Optic Laborer (Outside, Other Than Concrete Encased)	15.50	0.58	16.08
Railroad Track Laborer	17.50	2.17	19.67

HEAVY EQUIPMENT OPERATORS

Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Traveling Crane (Bridge Type).

Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017.

Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium.

See DOT'S website for details about the applicability of this night work premium at:

<http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevailing-wage-compliance.aspx>.

Backhoe (Track Type) Having a Mfr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs., & Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver.	37.77	21.85	59.62

Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017.

Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium.

See DOT'S website for details about the applicability of this night work premium at:

<http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevailing-wage-compliance.aspx>.

Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boatmen (NOT Performing Work on the Great Lakes); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type);	37.27	21.85	59.12

<u>TRADE OR OCCUPATION</u>	<u>HOURLY BASIC RATE OF PAY</u>	<u>HOURLY FRINGE BENEFITS</u>	<u>TOTAL</u>
	\$	\$	\$
Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A- Frames. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .			
Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .	37.01	21.85	58.86
Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .	37.27	21.85	59.12
Fiber Optic Cable Equipment.	18.00	0.00	18.00

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin

GENERAL DECISION NUMBER: WI160010

DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

DATE: April 8, 2016

LABORERS CLASSIFICATION:	Basic Hourly Rates	Fringe Benefits	Truck Drivers:	Basic Hourly Rates	Fringe Benefits
Group 1: General Laborer; Tree Trimmer; Conduit Layer; Demolition and Wrecking Laborer; Guard Rail, Fence and Bridge Builder; Landscaper, Multiplate Culvert Assembler; Stone Handler; Bituminous Worker (Shoveler, Loader, Utility Man); Batch Truck Dumper; or Cement Handler; Bituminous Worker; (Dumper, Ironer, Smoother, Tamper); Concrete Handler	\$30.67	15.55	1 & 2 Axles	25.63	18.96
Group 2: Air Tool Operator; Joint Sawyer and Filler (Pavement); Vibrator or Tamper Operator (Mechanical Hand Operated);	30.77	15.55	Three or More Axles; Euclids, Dumptor & Articulated, Truck Mechanic.....	25.63	18.96
Group 3: Bituminous Worker (Raker and Luteman); Formsetter (Curb, Sidewalk, and Pavement); Strike Off man.....	30.82	15.55			
Group 4: Line and Grade Specialist	31.02	15.55			
Group 5: Blaster and Powderman	30.87	15.55			
Group 6: Flagperson; Traffic Control.....	27.30	15.55			

CLASSES OF LABORER AND MECHANICS

Bricklayer	35.94.....	17.05
Carpenter	30.48.....	15.80
Millwright	32.11.....	15.80
Piledriverman	30.98.....	15.80
Ironworker	32.85	21.84
Cement Mason/Concrete Finisher	34.64.....	18.62
Electrician	See Page 3	
Line Construction		
Lineman.....	42.14	32% + 5.00
Heavy Equipment Operator	40.03.....	32% + 5.00
Equipment Operator.....	33.71	32% + 5.00
Heavy Groundman Driver.....	26.78	14.11
Light Groundman Driver	24.86	13.45
Groundsman.....	23.18	32% + 5.00
Painters	22.03	12.45
Well Drilling:		
Well Driller	16.52.....	3.70

Notes: Welders receive rate prescribed for craft performing operation to which welding is incidental. Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR, 5.5(a)(1)(ii)). Includes Modification #0 dated January 8, 2016; Modification #1 dated January 29, 2016; Modification #2 dated February 26, 2016; Modification #3 dated March 11, 2016.

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin

GENERAL DECISION NUMBER: WI160010

DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

DATE: April 8, 2016

LABORERS CLASSIFICATION:	Basic Hourly Rates	Fringe Benefits		Basic Hourly Rates	Fringe Benefits
Group 1: General Laborer; Tree Trimmer; Conduit Layer; Demolition and Wrecking Laborer; Guard Rail, Fence and Bridge Builder; Landscaper, Multiplate Culvert Assembler; Stone Handler; Bituminous Worker (Shoveler, Loader, Utility Man); Batch Truck Dumper; or Cement Handler; Bituminous Worker; (Dumper, Ironer, Smoother, Tamper); Concrete Handler	\$30.67	15.55			
Group 2: Air Tool Operator; Joint Sawyer and Filler (Pavement); Vibrator or Tamper Operator (Mechanical Hand Operated);	30.77	15.55			
Group 3: Bituminous Worker (Raker and Luteman); Formsetter (Curb, Sidewalk, and Pavement); Strike Off man	30.82	15.55			
Group 4: Line and Grade Specialist	31.02	15.55			
Group 5: Blaster and Powderman	30.87	15.55			
Group 6: Flagperson; Traffic Control	27.30	15.55			
			<u>Truck Drivers:</u>		
			1 & 2 Axles	25.63	18.96
			Three or More Axles; Euclids, Dumptor & Articulated, Truck Mechanic	25.63	18.96

CLASSES OF LABORER AND MECHANICS

Bricklayer	35.94	17.05
Carpenter	30.48	15.80
Millwright	32.11	15.80
Piledriverman	30.98	15.80
Ironworker	32.85	21.84
Cement Mason/Concrete Finisher	34.64	18.62
Electrician	See Page 3	
Line Construction		
Lineman	42.14	32% + 5.00
Heavy Equipment Operator	40.03	32% + 5.00
Equipment Operator	33.71	32% + 5.00
Heavy Groundman Driver	26.78	14.11
Light Groundman Driver	24.86	13.45
Groundsman	23.18	32% + 5.00
Painters	22.03	12.45
Well Drilling:		
Well Driller	16.52	3.70

Notes: Welders receive rate prescribed for craft performing operation to which welding is incidental. Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR, 5.5(a)(1)(ii)). Includes Modification #0 dated January 8, 2016; Modification #1 dated January 29, 2016; Modification #2 dated February 26, 2016; Modification #3 dated March 11, 2016.

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin

GENERAL DECISION NUMBER: WI160010

DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

DATE: April 8, 2016

<u>POWER EQUIPMENT OPERATORS CLASSIFICATION:</u>	<u>Basic Hourly Rates</u>	<u>Fringe Benefits</u>	<u>POWER EQUIPMENT OPERATORS CLASSIFICATION: (Continued)</u>	<u>Basic Hourly Rates</u>	<u>Fringe Benefits</u>
Group 1: Cranes, tower cranes and derricks, with or without attachments, with a lifting capacity of over 100 tons or cranes, tower cranes and derricks with boom, leads and/or jib lengths measuring 176 feet or longer	\$38.27	\$21.55	(scraper, dozer, pusher, loader); scraper - rubber tired (single or twin engine); endloader hydraulic backhoe (tractor-type); trenching machine; skid rigs; tractor, side boom (heavy); drilling or boring machine (mechanical heavy); roller (over 5 tons); percussion or rotary drilling machine; air track; blaster; loading machine (conveyor); tugger; boatmen; winches and A-frames; post driver; material hoist operator.	\$37.27	\$21.55
Group 2: Cranes, tower cranes and derricks, with or without attachments, with a lifting capacity of 100 tons or less or cranes, tower cranes and derricks with boom, leads and/or jib lengths measuring 175 feet or less, and backhoes (excavators) having a manufacturer's rated capacity of 3 cu. yds. and over, caisson rigs, pile driver, dredge operator, dredge engineer.	\$37.77	\$21.55	Group 4: Greaser, roller steel (5 tons or less); roller (pneumatic tired) - self-propelled; tractor (mounted or towed compactors and light equipment); shouldering machine; self-propelled chip spreader; concrete spreader; finishing machine; mechanical float; curing machine; power subgrader; joint saw (multiple blade) belting machine; burlap machine; texturing machine; tractor, endloader (rubber tired) - light; jeep digger; fork lift; mulcher; launch operator; fireman; environmental burner.	\$37.01	\$21.55
Group 3: Mechanic or welder - heavy duty equipment, cranes with a lifting capacity of 25 tons or less, concrete breaker (manual or remote); vibrator/sonic concrete breaker; concrete laser screed; concrete slipform paver; concrete batch plant operator; concrete pavement spreader - heavy duty (rubber tired); concrete spreader and distributor, automatic subgrader (concrete); concrete grinder and planing machine; concrete slipform curb and gutter machine; slipform concrete placer; tube finisher; hydro blaster (10,000 psi and over); bridge paver; concrete conveyor system; concrete pump; stabilizing mixer (self propelled); shoulder widener; asphalt plant engineer; bituminous paver; bump cutter and grooving machine; milling machine; screed (bituminous paver); asphalt heater, planer and scarifier; backhoes (excavators) having a manufacturers rated capacity of under 3 cu. yds.; grader or motor patrol; tractor			Group 5: Air compressor; power pack; vibratory hammer and extractor; heavy equipment, leadman; tank car heaters; stump chipper; curb machine operator; concrete proportioning plants generators; mudjack operator; rock breaker; crusher or screening plant; screed (milling machine); automatic belt conveyor and surge bin; pug mill operator; oiler; pump (over 3 inches); drilling machine helper.	\$36.72	\$21.55
			Group 6: Off - road material hauler with or without ejector	\$30.82	\$21.55
			Premium Pay: EPA Level "A" protection - \$3.00 per hour EPA Level "B" protection - \$2.00 per hour EPA Level "C" protection - \$1.00 per hours		

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin

GENERAL DECISION NUMBER: WI160010

DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

DATE: April 8, 2016

LABORERS CLASSIFICATION:

Rates

Benefits

			Area 4 -	BROWN, DOOR, KEWAUNEE, MANITOWOC (except Schleswig), MARINETTE (Wausauke and area south thereof), OCONTO, MENOMINEE (East of a line 6 miles West of the West boundary of Oconto County), SHAWANO (except area North of Townships of Aniwa and Hutchins) COUNTIES.
Electricians				
Area 1	\$29.60	26.5%+ 9.15		
Area 2:				
Electricians.....	31.21	18.92	Area 5 -	ADAMS, CLARK (Colby, Freemont, Lynn, Mayville, Sherman, Sherwood, Unity), FOREST, JUNEAU, LANGLADE, LINCOLN, MARATHON, MARINETTE (Area North of the town of Wausauke), MENOMINEE (Area West of a line 6 miles West of the West boundary of Oconto County), ONEIDA, PORTAGE, SHAWANO (Area North of the townships of Aniwa and Hutchins), VILAS AND WOOD COUNTIES
Area 3:				
Electrical contracts under \$130,000	28.96	18.26		
Electrical contracts over \$130,000	31.16	18.34		
Area 4:	29.84	29.50% + 9.37		
Area 5	28.96	24.85% + 9.70		
Area 6	37.02	29%+9.77	Area 6 -	KENOSHA COUNTY
Area 8				
Electricians.....	31.90	24.95% + 10.46	Area 8 -	DODGE, (Emmet Township only), GREEN, JEFFERSON, LAFAYETTE, RACINE (Burlington township), ROCK and WALWORTH COUNTIES
Area 9:				
Electricians.....	35.75	19.87		
Area 10	29.64	20.54	Area 9 -	COLUMBIA, DANE, DODGE, (area west of Hwy. 26, except Chester & Emmet Townships), GREEN LAKE (except townships of Berlin, Seneca and St. Marie), IOWA, MARQUETTE (except townships of Neshkoka, Crystal Lake, Newton and Springfield), and SAUK COUNTIES
Area 11	33.90	24.47		
Area 12	34.98	19.89	Area 10 -	CALUMET (Township of New Holstein), DODGE (East of Hwy. 26 including Chester Township), FOND DU LAC, MANITOWOC (Schleswig), and SHEBOYGAN COUNTIES
Area 13	35.13	23.26		
Teledata System Installer				
Area 14			Area 11 -	DOUGLAS COUNTY
Installer/Technician	22.50	12.72		
Sound & Communications			Area 12 -	RACINE (except Burlington township) COUNTY
Area 15				
Installer	16.47	14.84	Area 13 -	MILWAUKEE, OZAUKEE, WASHINGTON and WAUKESHA COUNTIES
Technician	26.00	17.70	Area 14 -	Statewide.
Area 1 -	CALUMET (except township of New Holstein), GREEN LAKE (N. part, including Townships of Berlin, St. Marie and Seneca), MARQUETTE (N. part, including Townships of Crystal Lake, Neshkoro, Newton & Springfield), OUTAGAMIE, WAUPACA, WAUSHARA and WINNEBAGO COUNTIES.		Area 15 -	DODGE (East of Hwy 26 including Chester Twp, excluding Emmet Twp), FOND DU LAC (Except Waupun), MILWAUKEE, OZAUKEE, MANITOWOC (Schleswig), WASHINGTON, AND WAUKESHA COUNTIES.
Area 2 -	ASHLAND, BARRON, BAYFIELD, BUFFALO, BURNETT, CHIPPEWA, CLARK (except Mayville, Colby, Unity, Sherman, Fremont, Lynn and Sherwood), CRAWFORD, DUNN, EAU CLAIRE, GRANT, IRON, JACKSON, LA CROSSE, MONROE, PEPIN, PIERCE, POLK, PRICE, RICHLAND, RUSK, ST. CROIX, SAWYER, TAYLOR, TREMPLEAU, VERNON and WASHBURN COUNTIES			
Area 3 -	FLORENCE (townships of Aurora, Commonwealth, Fern, Florence and Homestead), MARINETTE (Niagara township)			

State of Wisconsin Department of Workforce Development Equal Rights Division	DEPARTMENTAL ORDER
ISSUE DATE: 5/16/2016	
PROJECT:	
SPARTA SAFETY AND WEIGHT ENFORCEMENT FACILITY NO. 54 SPARTA TOWN, MONROE COUNTY, WI Determination No. 201601546 [Owner Project No. 1070-00-72]	
PROJECT OWNER:	REQUESTER:
ROBERT SPOERL, ROADSIDE FACILITIES ENGINEER DEPARTMENT OF TRANSPORTATION 4802 SHEBOYGAN AVE. 501 MADISON, WI 53705	BRIAN GUTHRIE, ARCHITECT VANTAGE ARCHITECTS INC 750 N THIRD ST, STE F LA CROSSE, WI 54601
ADDITIONAL CONTACT:	
ROBERT SPOERL, ROADSIDE FACILITIES ENGINEER DEPARTMENT OF TRANSPORTATION 4802 SHEBOYGAN AVE. 501 MADISON, WI 53705	
The department received an application for prevailing wage rate determination for the above-captioned project. The department conducted a survey to determine the prevailing wage rate for the trade(s) or occupation(s) needed to complete the project. The survey's findings appear in the attached project determination. If you believe that the wage rate for any trade or occupation does not accurately reflect the prevailing wage rate in the city, village or town where the project is located, you may ask the department to conduct an administrative review of such wage rate. You must submit this request in writing within 30 days from the date indicated above. Additionally, your request must include wage rate information from at least three similar projects in the city, village or town where the proposed project is located and on which some work has been performed by the contested trade(s) during the current survey period and was previously considered by the department in issuing the attached determination. See DWD 290.10 of the Wisconsin Administrative Code and either s. 66.0903(3)(br), Stats., or s. 103.49(3)(c), Stats., for a complete explanation of the administrative review process. Enclosures	
It is hereby ordered that the prevailing wage rates set forth in the attached project determination shall only be applicable to the above referenced project. This order is a FINAL ORDER of the department unless a timely request for an administrative review is filed with the department. ISSUED BY: Equal Rights Division Labor Standards Bureau Construction Wage Standards Section P.O. Box 8928, Madison, WI 53708-8928 (608)266-6861 Web Site: http://dwd.wisconsin.gov/er/	

PREVAILING WAGE RATE DETERMINATION

Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 103.49, Wis. Stats.
Issued On: 5/16/2016

DETERMINATION NUMBER: 201601546

EXPIRATION DATE: Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2016. If NOT, You MUST Reapply.

PROJECT NAME: SPARTA SAFETY AND WEIGHT ENFORCEMENT FACILITY NO. 54
PROJECT NO: 1070-00-72

PROJECT LOCATION: SPARTA TOWN, MONROE COUNTY, WI

CONTRACTING AGENCY: DEPARTMENT OF TRANSPORTATION

CLASSIFICATION:	Contractors are responsible for correctly classifying their workers. Either call the Department of Workforce Development (DWD) with trade or classification questions or consult DWD's Dictionary of Occupational Classifications & Work Descriptions on the DWD website at: dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm .
OVERTIME:	Time and one-half must be paid for all hours worked: - over 10 hours per day on prevailing wage projects - over 40 hours per calendar week - Saturday and Sunday - on all of the following holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; - The day before if January 1, July 4 or December 25 falls on a Saturday; - The day following if January 1, July 4 or December 25 falls on a Sunday. Apply the time and one-half overtime calculation to whichever is higher between the Hourly Basic Rate listed on this project determination or the employee's regular hourly rate of pay. Add any applicable Premium or DOT Premium to the Hourly Basic Rate before calculating overtime. A DOT Premium (discussed below) may supersede this time and one-half requirement.
FUTURE INCREASE:	When a specific trade or occupation requires a future increase, you MUST add the full hourly increase to the "TOTAL" on the effective date(s) indicated for the specific trade or occupation.
PREMIUM PAY:	If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whenever such pay is applicable.
DOT PREMIUM:	This premium only applies to highway and bridge projects owned by the Wisconsin Department of Transportation and to the project type heading "Airport Pavement or State Highway Construction." DO NOT apply the premium calculation under any other project type on this determination.
APPRENTICES:	Pay apprentices a percentage of the applicable journey person's hourly basic rate of pay and hourly fringe benefit contributions specified in this determination. Obtain the appropriate percentage from each apprentice's contract or indenture.
SUBJOURNEY:	Subjourney wage rates may be available for some of the trades or occupations indicated below with the exception of laborers, truck drivers and heavy equipment operators. Any employer interested in using a subjourney classification on this project MUST complete Form ERD-10880 and request the applicable wage rate from the Department of Workforce Development PRIOR to using the subjourney worker on this project.

This document **MUST BE POSTED** by the **CONTRACTING AGENCY** in at least one conspicuous and easily accessible place **on the site of the project**. A local governmental unit may post this document at the place normally used to post public notices if there is no common site on the project. This document **MUST** remain posted during the entire time any worker is employed on the project and **MUST** be physically incorporated into the specifications and all contracts and subcontracts. If you have any questions, please write to the Equal Rights Division, Labor Standards Bureau, P.O. Box 8928, Madison, Wisconsin 53708 or call (608) 266-6861.

The following statutory provisions apply to state agency projects of public works and are set forth below pursuant to the requirements of s. 103.49(3)(a), Stats.

s. 103.49 (1) (c) "PREVAILING HOURS OF LABOR" for any trade or occupation in any area means 10 hours per day and 40 hours per week and may not include any hours worked on a Saturday or Sunday or on any of the following holidays:

1. January 1.
2. The last Monday in May.
3. July 4.
4. The first Monday in September.
5. The 4th Thursday in November.
6. December 25.
7. The day before if January 1, July 4 or December 25 falls on a Saturday.
8. The day following if January 1, July 4 or December 25 falls on a Sunday.

s. 103.49 (2) PREVAILING WAGE RATES AND HOURS OF LABOR.

Any contract made for the erection, construction, remodeling, repairing, or demolition of any project of public works to which the state or any state agency is a party shall contain a stipulation that no person performing the work described in sub. (2m) may be permitted to work a greater number of hours per day or per week than the prevailing hours of labor, except that any such person may be permitted or required to work more than such prevailing hours of labor per day and per week if he or she is paid for all hours worked in excess of the prevailing hours of labor at a rate of at least 1.5 times his or her hourly basic rate of pay; nor may he or she be paid less than the prevailing wage rate determined under sub. (3) in the same or most similar trade or occupation in the area in which the project of public works is situated. A reference to the prevailing wage rates determined under sub. (3) and the prevailing hours of labor shall be published in the notice issued for the purpose of securing bids for the project. If any contract or subcontract for a project of public works that is subject to this section is entered into, the prevailing wage rates determined under sub. (3) and the prevailing hours of labor shall be physically incorporated into and made a part of the contract or subcontract, except that for a minor subcontract, as determined by the department, the department shall prescribe by rule the method of notifying the minor subcontractor of the prevailing wage rates and prevailing hours of labor applicable to the minor subcontract. The prevailing wage rates and prevailing hours of labor applicable to a contract or subcontract may not be changed during the time that the contract or subcontract is in force.

s. 103.49 (6M) LIABILITY AND PENALTIES.

- (ag) 1. Any contractor, subcontractor, or contractor's or subcontractor's agent who fails to pay the prevailing wage rate determined by the department under sub. (3) or who pays less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor is liable to any affected employee in the amount of his or her unpaid wages or his or her unpaid overtime compensation and in an additional amount as liquidated damages as provided in subd. 2., 3., whichever is applicable.
2. If the department determines upon inspection under sub. (5) (b) or (c) that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the department shall order the contractor to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages within a period specified by the department in the order.
3. In addition to or in lieu of recovering the liability specified in subd. 1. as provided in subd. 2., any employee for and in behalf of that employee and other employees similarly situated may commence an action to recover that liability in any court of competent jurisdiction. If the court finds that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the court shall order the contractor, subcontractor, or agent to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages.

(am) Except as provided in pars. (b), (d) and (f), any contractor, subcontractor or contractor's or subcontractor's agent who violates this section may be fined not more than \$200 or imprisoned for not more than 6 months or both. Each day that a violation continues is a separate offense.

(b) Whoever induces any person who seeks to be or is employed on any project of public works that is subject to this section to give up, waive, or return any part of the wages to which the person is entitled under the contract governing the project, or who reduces the hourly basic rate of pay normally paid to a person for work on a project that is not subject to this section during a week in which the person works both on a project of public works that is subject to this section and on a project that is not subject to this section, by threat not to employ, by threat of dismissal from employment, or by any other means is guilty of an offense under s. 946.15 (1).

(c) Any person employed on a project of public works that is subject to this section who knowingly permits a contractor, subcontractor, or contractor's or subcontractor's agent to pay him or her less than the prevailing wage rate set forth in the contract governing the project, who gives up, waives, or returns any part of the compensation to which he or she is entitled under the contract, or who gives up, waives, or returns any part of the compensation to which he or she is normally entitled for work on a project that is not subject to this section during a week in which the person works both on a project of public works that is subject to this section and on a project that is not subject to this section, is guilty of an offense under s. 946.15 (2).

(d) Whoever induces any person who seeks to be or is employed on any project of public works that is subject to this section to permit any part of the wages to which the person is entitled under the contract governing the project to be deducted from the person's pay is guilty of an offense under s. 946.15 (3), unless the deduction would be permitted under 29 CFR 3.5 or 3.6 from a person who is working on a project that is subject to 40 USC 3142.

(e) Any person employed on a project of public works that is subject to this section who knowingly permits any part of the wages to which he or she is entitled under the contract governing the project to be deducted from his or her pay is guilty of an offense under s. 946.15 (4), unless the deduction would be permitted under 29 CFR 3.5 or 3.6 from a person who is working on a project that is subject to 40 USC 3142.

5. No employee may be a party plaintiff to an action under subd. 3. unless the employee consents in writing to become a party and the consent is filed in the court in which the action is brought. Notwithstanding s. 814.04 (1), the court shall, in addition to any judgment awarded to the plaintiff, allow reasonable attorney fees and costs to be paid by the defendant.

BUILDING OR HEAVY CONSTRUCTION

Includes sheltered enclosures with walk-in access for the purpose of housing persons, employees, machinery, equipment or supplies and non-sheltered work such as canals, dams, dikes, reservoirs, storage tanks, etc. A sheltered enclosure need not be "habitable" in order to be considered a building. The installation of machinery and/or equipment, both above and below grade level, does not change a project's character as a building. On-site grading, utility work and landscaping are included within this definition. Residential buildings of four (4) stories or less, agricultural buildings, parking lots and driveways are NOT included within this definition.

SKILLED TRADES

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
101	Acoustic Ceiling Tile Installer Future Increase(s): Add \$1.42/hr on 6/1/2016.	33.02	17.12	50.14
102	Boilermaker	33.35	28.04	61.39
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add \$1.45 on 06/06/2016 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	31.22	19.98	51.20
104	Cabinet Installer Future Increase(s): Add \$1.42/hr on 6/1/2016.	33.02	17.12	50.14
105	Carpenter	32.72	13.17	45.89
106	Carpet Layer or Soft Floor Coverer Future Increase(s): Add \$1.42/hr on 6/1/2016.	33.02	17.12	50.14
107	Cement Finisher Future Increase(s): Add \$1.50 on 05/30/2016;	27.36	20.44	47.80
108	Drywall Taper or Finisher	19.00	9.68	28.68
109	Electrician	27.69	8.12	35.81
110	Elevator Constructor	46.05	27.09	73.14
111	Fence Erector	19.27	6.84	26.11
112	Fire Sprinkler Fitter	38.28	18.81	57.09
113	Glazier	31.38	8.32	39.70
114	Heat or Frost Insulator	33.53	27.25	60.78
115	Insulator (Batt or Blown)	23.62	11.55	35.17
116	Ironworker	32.50	20.58	53.08

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
117	Lather	32.72	13.17	45.89
118	Line Constructor (Electrical)	37.77	26.40	64.17
119	Marble Finisher	25.72	18.54	44.26
120	Marble Mason	30.98	18.83	49.81
121	Metal Building Erector	18.32	7.95	26.27
122	Millwright Future Increase(s): Add \$1.47/hr on 6/1/2016.	34.79	17.17	51.96
123	Overhead Door Installer	21.69	3.72	25.41
124	Painter	26.70	16.65	43.35
125	Pavement Marking Operator	30.00	18.81	48.81
126	Piledriver Future Increase(s): Add \$1.44/hr on 6/1/2016. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.56	17.12	50.68
127	Pipeline Fuser or Welder (Gas or Utility)	35.55	16.12	51.67
129	Plasterer Future Increase(s): Add \$1.40 on 06/01/2016; Add \$1.50 on 06/01/2017 Premium Increase(s): Add \$.25/hr. for work on swing scaffolds.	30.43	18.77	49.20
130	Plumber	31.50	0.86	32.36
132	Refrigeration Mechanic	36.75	16.32	53.07
133	Roofer or Waterproofer	20.82	10.48	31.30
134	Sheet Metal Worker	28.75	21.68	50.43
135	Steamfitter	36.75	16.32	53.07
137	Teledata Technician or Installer	17.50	5.57	23.07
138	Temperature Control Installer	19.58	2.27	21.85
139	Terrazzo Finisher	25.72	18.54	44.26
140	Terrazzo Mechanic Future Increase(s): Add \$1.45 on 06/06/2016	31.59	19.60	51.19
141	Tile Finisher	30.00	0.00	30.00
142	Tile Setter	30.98	18.99	49.97

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
143	Tuckpointer, Caulker or Cleaner Future Increase(s): Add \$1.45 on 06/06/2016 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	31.36	19.84	51.20
144	Underwater Diver (Except on Great Lakes)	36.74	16.00	52.74
146	Well Driller or Pump Installer Future Increase(s): Add \$1/hr on 6/1/2016; Add \$1/hr on 6/1/2017.	25.32	16.40	41.72
147	Siding Installer	17.00	6.71	23.71
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	39.57	24.46	64.03
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	32.65	15.52	48.17
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	28.57	13.71	42.28
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.53	13.55	40.08
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	25.00	12.55	37.55

TRUCK DRIVERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
201	Single Axle or Two Axle Future Increase(s): Add \$1.15/hr on 6/1/2015. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	25.68	18.96	44.64
203	Three or More Axle	26.10	4.33	30.43
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	25.78	18.96	44.74
205	Pavement Marking Vehicle	26.10	4.33	30.43
207	Truck Mechanic	26.10	4.33	30.43

LABORERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
301	General Laborer Future Increase(s): Add \$1.25/hr eff. 06/06/2016 Premium Increase(s): Add \$1.00/hr for certified welder and pipelayer; Add \$.25/hr for mason tender.	25.81	15.63	41.44
302	Asbestos Abatement Worker	25.02	15.63	40.65
303	Landscaper	11.00	10.29	21.29
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	21.14	14.65	35.79
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	15.50	0.58	16.08
314	Railroad Track Laborer	17.50	2.17	19.67
315	Final Construction Clean-Up Worker	29.01	17.39	46.40

**HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
501	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Milling Machine; Boring Machine (Directional, Horizontal or Vertical); Backhoe (Track Type) Having a Mfg's Rated Capacity of 130,000 Lbs. or Over; Backhoe (Track Type) Having a Mfg's Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Crane, Shovel, Dragline, Clamshells; Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Grader or Motor Patrol; Master Mechanic; Mechanic or Welder; Robotic Tool Carrier (With or Without Attachments); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Tractor (Scraper, Dozer, Pusher, Loader); Trencher (Wheel Type or Chain Type Having Over 8 Inch Bucket). Future Increase(s): Add \$1.60/hr on 6/3/2016.	35.22	20.38	55.60
502	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Environmental Burner; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Jeep Digger; Screed (Milling Machine); Skid Rig; Straddle Carrier or Travel Lift; Stump Chipper; Trencher (Wheel Type or Chain Type Having 8 Inch Bucket & Under). Future Increase(s): Add \$1.60/hr on 6/3/2016.	34.69	20.38	55.07

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
503	Air Compressor (&/or 400 CFM or Over); Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Greaser; High Pressure Utility Locating Machine (Daylighting Machine); Mulcher; Oiler; Post Hole Digger or Driver; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.60/hr on 6/3/2016.	34.69	20.38	55.07
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	41.65	21.71	63.36
505	Work Performed on the Great Lakes Including Crane or Backhoe Operator; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder; 70 Ton & Over Tug Operator. Future Increase(s): Add \$1.25/hr on 1/1/2017. Premium Increase(s): Add \$.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	44.05	23.24	67.29
506	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery. Future Increase(s): Add \$1.25/hr on 1/1/2017.	39.20	23.09	62.29
507	Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	36.72	21.15	57.87

**HEAVY EQUIPMENT OPERATORS
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
508	Boring Machine (Directional); Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Future Increase(s): Add \$1.60/hr on 6/3/2016. Premium Increase(s):	37.67	20.38	58.05

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
	Add \$.50/hr for >200 Ton; Add \$1/hr at 300 Ton; Add \$1.50/hr at 400 Ton; Add \$2/hr at 500 Ton & Over.			
509	Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Boring Machine (Horizontal or Vertical); Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Pile Driver; Versi Lifts, Tri-Lifts & Gantrys (20,000 Lbs. & Over). Future Increase(s): Add \$1.60/hr on 6/3/2016. Premium Increase(s): Add \$.25/hr for all >45 Ton lifting capacity cranes.	36.42	20.38	56.80
510	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Dredge (NOT Performing Work on the Great Lakes); Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Hydro-Blaster (10,000 PSI or Over); Milling Machine; Skid Rig; Traveling Crane (Bridge Type).	33.69	20.00	53.69
511	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Environmental Burner; Gantrys (Under 20,000 Lbs.); Grader or Motor Patrol; High Pressure Utility Locating Machine (Daylighting Machine); Manhoist; Material or Stack Hoist; Mechanic or Welder; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tining or Curing Machine; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).	33.69	10.51	44.20
512	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Grout Pump; Hoist (Tugger, Automatic); Industrial Locomotives; Jeep Digger; Lift Slab Machine; Mulcher; Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames. Future Increase(s): Add \$1.60/hr on 6/3/2016.	32.62	20.38	53.00

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
513	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Boatmen (NOT Performing Work on the Great Lakes); Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Elevator; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Forklift; Generator (&/or 150 KW or Over); Greaser; Heaters (Mechanical); Loading Machine (Conveyor); Oiler; Post Hole Digger or Driver; Prestress Machine; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.60/hr on 6/3/2016.	31.99	20.38	52.37
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment). Future Increase(s): Add \$1/hr on 5/30/2016.	37.04	22.44	59.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment).	33.82	20.30	54.12
516	Fiber Optic Cable Equipment	18.00	0.00	18.00

SEWER, WATER OR TUNNEL CONSTRUCTION

Includes those projects that primarily involve public sewer or water distribution, transmission or collection systems and related tunnel work (excluding buildings).

SKILLED TRADES

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked				
<u>CODE</u>	<u>TRADE OR OCCUPATION</u>	<u>HOURLY BASIC RATE OF PAY</u>	<u>HOURLY FRINGE BENEFITS</u>	<u>TOTAL</u>
		\$	\$	\$
103	Bricklayer, Blocklayer or Stonemason	30.98	18.83	49.81
105	Carpenter	32.72	13.17	45.89
107	Cement Finisher Future Increase(s): Add \$1.75 on 6/1/16. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	35.97	17.85	53.82
109	Electrician Future Increase(s): Add \$1.60 on 6/1/16; Add \$1.70 on 6/1/17 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	35.13	23.19	58.32
111	Fence Erector	19.27	6.84	26.11
116	Ironworker	32.50	20.58	53.08
118	Line Constructor (Electrical)	37.77	26.40	64.17
125	Pavement Marking Operator	30.00	18.81	48.81
126	Piledriver	33.24	16.00	49.24
130	Plumber Future Increase(s): Add \$1.50 on 6/1/16	39.95	19.45	59.40
135	Steamfitter	35.55	16.12	51.67
137	Teledata Technician or Installer	17.50	5.57	23.07
143	Tuckpointer, Caulker or Cleaner	31.12	18.69	49.81
144	Underwater Diver (Except on Great Lakes)	31.00	20.43	51.43
146	Well Driller or Pump Installer Future Increase(s): Add \$1/hr on 6/1/2016; Add \$1/hr on 6/1/2017.	25.32	16.40	41.72

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	36.73	15.92	52.65
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	32.65	15.52	48.17
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	28.57	13.71	42.28
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.53	13.55	40.08
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.97	34.72

TRUCK DRIVERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
201	Single Axle or Two Axle	19.00	0.00	19.00
203	Three or More Axle	19.00	0.00	19.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	33.69	19.78	53.47
205	Pavement Marking Vehicle	19.00	0.00	19.00
207	Truck Mechanic	19.00	0.00	19.00

LABORERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
301	General Laborer Future Increase(s): Add \$1.25/hr eff. 06/06/2016 Premium Increase(s): Add \$.20 for blaster, bracer, manhole builder, caulker, bottomman and power tool; Add \$.55 for pipelayer; Add \$1.00 for 0-15 lbs. compressed air; Add \$2.00 for 15-30 lbs. compressed air; Add \$3.00 for over 30 lbs. compressed air.	26.93	15.64	42.57
303	Landscaper	41.00	0.00	41.00
304	Flagperson or Traffic Control Person	26.76	15.14	41.90
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	15.50	0.58	16.08
314	Railroad Track Laborer	17.50	2.17	19.67

**HEAVY EQUIPMENT OPERATORS
SEWER, WATER OR TUNNEL WORK**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
521	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Master Mechanic; Pile Driver. Premium Increase(s): Add \$.25/hr for operating tower crane.	38.09	20.80	58.89
522	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Spreader & Distributor; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Dredge (NOT Performing Work on the Great Lakes); Milling Machine; Skid Rig; Telehandler; Traveling Crane (Bridge Type). Future Increase(s): Add \$1.60/hr on 6/3/2016.	35.22	20.38	55.60
523	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Boring Machine (Horizontal or Vertical); Bulldozer or Endloader (Over 40 hp); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Manhoist; Material or Stack Hoist; Mechanic or Welder; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket). Premium Increase(s): Add \$.25/hr for operating tower crane.	36.36	20.80	57.16

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
524	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Environmental Burner; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Hoist (Tugger, Automatic); Grout Pump; Jeep Digger; Lift Slab Machine; Mulcher; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Tining or Curing Machine; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames.	33.69	21.75	55.44
525	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Loading Machine (Conveyor); Post Hole Digger or Driver; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	30.19	22.06	52.25
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	30.99	19.78	50.77
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	41.65	21.71	63.36
528	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	41.65	21.71	63.36
529	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	36.72	21.15	57.87
530	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under), Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	36.72	21.15	57.87

LOCAL STREET OR MISCELLANEOUS PAVING CONSTRUCTION

Includes roads, streets, alleys, trails, bridges, paths, racetracks, parking lots and driveways (except residential or agricultural), public sidewalks or other similar projects (excluding projects awarded by the Wisconsin Department of Transportation).

SKILLED TRADES

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked				
CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY \$	HOURLY FRINGE BENEFITS \$	TOTAL \$
103	Bricklayer, Blocklayer or Stonemason	30.98	18.83	49.81
105	Carpenter Future Increase(s): Add \$1.42/hr on 6/1/2016. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.02	17.12	50.14
107	Cement Finisher Future Increase(s): Add \$1.50 on 05/30/2016;	27.36	20.44	47.80
109	Electrician	34.82	20.39	55.21
111	Fence Erector	19.27	6.84	26.11
116	Ironworker	32.50	20.58	53.08
118	Line Constructor (Electrical)	37.77	26.40	64.17
124	Painter	26.70	16.65	43.35
125	Pavement Marking Operator	30.00	18.81	48.81
126	Piledriver Future Increase(s): Add \$1.44/hr on 6/1/2016. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.56	17.12	50.68
133	Roofer or Waterproofor	20.82	10.48	31.30
137	Teledata Technician or Installer	17.50	5.57	23.07
143	Tuckpointer, Caulker or Cleaner	31.12	18.69	49.81
144	Underwater Diver (Except on Great Lakes)	36.74	16.00	52.74
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	36.73	15.92	52.65
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	32.65	15.52	48.17
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	28.57	13.71	42.28

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.53	13.55	40.08
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.97	34.72

TRUCK DRIVERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
201	Single Axle or Two Axle	19.50	0.20	19.70
203	Three or More Axle	19.50	0.20	19.70
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add \$1.60/hr on 6/3/2016.	34.69	20.38	55.07
205	Pavement Marking Vehicle	19.50	0.20	19.70
206	Shadow or Pilot Vehicle	19.50	0.20	19.70
207	Truck Mechanic	19.50	0.20	19.70

LABORERS

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
301	General Laborer	28.40	15.14	43.54
303	Landscaper Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017 Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	30.67	15.65	46.32

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
304	Flagperson or Traffic Control Person Future Increase(s): Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017 Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	27.30	15.65	42.95
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	15.50	0.58	16.08
314	Railroad Track Laborer	17.50	2.17	19.67

**HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
541	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Future Increase(s): Add \$1.60/hr on 6/3/2016. Premium Increase(s): Add \$.50/hr for >200 Ton; Add \$1/hr at 300 Ton; Add \$1.50/hr at 400 Ton; Add \$2/hr at 500 Ton & Over.	37.67	20.38	58.05
542	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Crane, Tower Crane Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsindot.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx .	37.77	21.85	59.62

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
543	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx.	37.27	21.85	59.12
544	Backfiller; Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsin.gov/Pages/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx.	37.27	21.85	59.12

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
545	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.	31.62	19.78	51.40
546	Fiber Optic Cable Equipment.	18.00	0.00	18.00
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	41.65	21.71	63.36
548	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder. Future Increase(s): Add \$1.25/hr on 1/1/2017. Premium Increase(s): Add \$.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	44.05	23.24	67.29
549	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or more); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	36.72	21.15	57.87
550	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	36.72	21.15	57.87

**HEAVY EQUIPMENT OPERATORS
ASPHALT PAVEMENT OR OTHER WORK**

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
551	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads and/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.	36.67	19.78	56.45

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
CODE	TRADE OR OCCUPATION	\$	\$	\$
552	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add \$1.30/hr on 6/1/2016; Add \$1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http://wisconsindot.gov/Page s/doing-bus/civil-rights/labornwage/prevaling-wage-compliance.aspx.	37.77	21.85	59.62
553	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Laser/Screed; Concrete Slipform Placer Curb & Gutter Machine; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames.	36.17	20.85	57.02
554	Backfiller; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self-Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler.	36.17	20.85	57.02

Fringe Benefits Must Be Paid On <u>All</u> Hours Worked		HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
<u>CODE</u>	<u>TRADE OR OCCUPATION</u>	\$	\$	\$
555	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add \$1.60/hr on 6/3/2016.	32.62	20.38	53.00
556	Fiber Optic Cable Equipment.	18.00	0.00	18.00
***** END OF RATES *****				

The documents following the Prevailing Wage Rate Determination consist of twenty pages (including this one) of various forms/documents that will be used throughout the completion of the project. This prevailing wage rate determination and its underlying legal requirements outlined in the attached documents apply for the life of this project even though work on the project continues into 2017 or beyond. The chart below lists the form number, form/document name, the party who uses the document, and the document's number of pages. If you have any questions regarding these forms please call the Prevailing Wage Office at (608)266-6861.

ERD Form Number	Form Name	Party Who Uses the Form	Pages
	July 2015 description of recent changes to Wisconsin's prevailing wage laws resulting from enactment of the 2015-17 State Budget Bill.		1
	Prevailing Wage - Public Entity Project Owners	Explanation of project owner responsibilities	2
16056	Post the White Sheet	Contracting agency	1
10908	Consolidated List of Debarred Contractors	Any party contracting someone to complete work on a prevailing wage project	4
	Prevailing Wage – Contractors	Explanation of contractor responsibilities	2
7777	Disclosure of Ownership	Contractors that meet the criteria set out in (3)(A)&(B) of the form	1
5724	Prime Contractor Affidavit of Compliance	Prime contractor files with contracting agency upon completion of the work before receiving final payment	2
10584	Agent or Subcontractor Affidavit of Compliance	Subcontractors file with their awarding contractor upon completion of their work on the project before receiving final payment	2
10880	Request to Employ Subjourneyperson	Contractors wishing to employ a subjourneyperson(s)	1
	Additional General Prevailing Wage Law Information	General information for public entity or any other interested party	3

02/16/2016

THE 2015-17 BUDGET BILL MADE SIGNIFICANT CHANGES TO WISCONSIN'S PREVAILING WAGE LAWS. HOWEVER, THOSE CHANGES DO NOT GO INTO EFFECT UNTIL JANUARY 1, 2017.

During calendar year 2016, DWD will continue to enforce prevailing wage laws for local governmental unit and state agency public works projects under current prevailing wage laws.

2015 Wisconsin Act 55 (the budget bill) repealed the state prevailing wage law for **local governmental units** such as villages, towns, cities, school districts, or sewerage districts effective January 1, 2017. However, if a local governmental unit:

- issues a Request for Bids before January 1, 2017, for a project of public works that is subject to bidding or,
- enters into a contract before January 1, 2017, for a project of public works that is not subject to bidding,

then those public works projects are subject to the current prevailing wage law (§66.0903, Wis. Stats.) through the life of the project. Projects of public works with prevailing wage project determinations issued prior to 2017 continue to be subject to the current prevailing wage law through the life of the project even though the project may have work going on in 2017 or subsequent years.

Contractors working on local governmental unit projects with prevailing wage rate determinations must continue to pay employees the appropriate prevailing wage and maintain required prevailing wage payroll records. For instance, if a contractor is working in 2018 on a public works project with a project determination issued prior to 2017, then the contractor is required to comply with the "old" prevailing wage rate law (§66.0903, Wis. Stats.). After January 1, 2017, DWD will continue to enforce prevailing wage requirements for projects with DWD prevailing wage determinations issued under the "old" prevailing wage laws (§§ 66.0903 & 103.49, Wis. Stats.).

For new public works projects starting on January 1, 2017, state prevailing wage law will only apply to **state agency** and **state highway** projects. Prevailing wage rates applicable to state agencies will be those issued by the U.S. Department of Labor under the Davis-Bacon Act, 40 U.S.C. 3142. The Wisconsin Department of Administration will enforce the new state agency prevailing wage law (§16.856, Wis. Stats.) and the Wisconsin Department of Transportation will continue to enforce prevailing wage on state highway projects (under a law renumbered as §84.062, Wis. Stats.).

PREVAILING WAGE – Public Entity Project Owners

Any public works project that has a total estimated project cost that equals or exceeds single-trade or multiple-trade project thresholds requires a prevailing wage rate determination issued by the Department of Workforce Development (DWD). Public works include erecting, constructing, remodeling, repairing, demolishing, alterations, painting and decorating projects for a local governmental unit or state agency. State law excludes minor service or maintenance work, warranty work, or work under a supply-and-installation contract. There is a statutory definition for most of these exclusions. The prevailing wage law that applies to local governmental units is §66.0903, Wis. Stats. The prevailing wage law that applies to state agencies is §103.49, Wis. Stats. The applicable administrative rules for all public entities are DWD 290 and DWD 294, Wis. Adm. Code.

Thresholds

- A "single-trade project of public works" means a project in which a single trade accounts for 85% or more of the total labor cost of the project. The single trade threshold is \$48,000.
- A "multiple-trade project of public works" means a project in which no single trade accounts for 85% or more of the total labor cost of the project.
- (a) The multiple-trade threshold is \$100,000, unless a municipality falls under the description in (b).
 - (b) The multiple-trade threshold of \$234,000 applies to public works projects erected, constructed, repaired, remodeled, or demolished by a private contractor for •a city or village with a population less than 2500 or •a town.

A local governmental unit or state agency that has a public works project that equals or exceeds the prevailing wage thresholds must do all of the following:

- Request a prevailing wage rate determination for the project from DWD at least 30 days before soliciting bids or negotiating contracts. An Application for Prevailing Wage Rate Determination is available on the DWD website: http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm
To avoid waiting for a project determination use the on-line application system that permits the user to generate a determination immediately and save all documents in PDF form to the user's computer. Use this project determination on line application at the following address:

- Tell potential contractors the project is subject to state prevailing wage law when soliciting bids.
- Include the prevailing wage rate determination in the construction contract, or if there is no written contract, provide a copy of the project determination to each prime contractor.
- Award contracts to contractors who do *not* appear on the "Consolidated List of Debarred Contractors."
- Notify contractors that they are required to have a written substance abuse testing program in place that fulfills the requirements of §103.503, Wis. Stats., before commencing work on the prevailing wage project.
- Post the prevailing wage rate determination on the project site. (This document is often referred to as "the white sheet.")
- Notify project contractors that if DWD finds that a contractor violated the prevailing wage law, DWD will assess liquidated damages of 100% of the wages owed to employees.
- Obtain an Affidavit of Compliance from each prime contractor before making final payment for the project.

If the total estimated cost of the project exceeds the prevailing wage thresholds, a local governmental unit or state agency also must obtain a prevailing wage rate determination under the following circumstances:

- when a completed facility is leased, purchased, lease-purchased or otherwise acquired by or dedicated to a public entity in lieu of the public entity contracting for the project,
- when one public entity does work for another public entity,
- when a *private* entity will construct a road, street, bridge, sanitary sewer or water main project and dedicate it to a local governmental unit or the state for its ownership or maintenance (except for some residential subdivisions).

For more information, visit the prevailing wage website: http://dwd.wisconsin.gov/er/prevaling_wage_rate/default.htm. For further assistance, call the Equal Rights Division at 608-266-6861 and ask for prevailing wage.

POST THE WHITE SHEET

As the public entity receiving this prevailing wage rate determination, YOU ARE REQUIRED by law to post the prevailing wage rate determination (i.e., white sheet) in at least one conspicuous and easily accessible place on the project site that is available to all construction workers. The white sheet must remain posted from the onset of the project until all construction labor on the project has been completed.

[See, Wis. Admin. Code §DWD 290.12(1)]

Posting the white sheet inside the general contractor's trailer does not meet this requirement. That placement is not available/accessible to all workers and is not a location over which you have control.

If you have questions about posting, please call (608)266-6861 and ask for prevailing wage intake.

State of Wisconsin - Department of Workforce Development

This list has been prepared in accordance with the provisions of §§66.0903(12) and 103.49(7), Wis. Stats., and Chapter DWD 294 of the Wisconsin Administrative Code. All contractors on this list were found to have committed a "debarable offense" related to certain labor standard provisions determined or established for a state or local public works project. No state agency, local governmental unit or owner or developer may knowingly solicit bids from, negotiate with or award any contracts to or approve or allow any subcontracts with a debarred contractor, including all divisions, affiliates or other organizational elements of such contractor that are engaged in construction business activities, until the debarment is terminated. The name of each debarred contractor must remain on this list for a period of three (3) years from the termination date indicated below. The contractor is, however, only "debarred" from the "effective date" through the "termination date" indicated for that contractor. Questions regarding this list should be addressed to Jim Chiolino, Equal Rights Division, P. O. Box 8928, Madison, WI 53708 or call (608) 266-3345. Deaf, hearing or speech-impaired callers may contact the department by calling its TDD number (608) 264-8752.

<u>Name of Contractor</u>	<u>Address</u>	<u>Effective Date</u>	<u>Termination Date</u>	<u>Cause Code</u>	<u>Date of Violation(s)</u>	<u>Limitations/Deviations</u>
A-1 Duran Roofing & Insulation Services, Inc.	3700 N Fratney St Milwaukee, WI 53212 or 8095 NW 64 th St Miami, FL 33166	11/1/14	10/31/17	1, 2 and 4	2011- 2012	None
Abel, Mike	See, Abel Electric, Inc					
Abel Electric, Inc	3385 Belmar Rd Green Bay, WI 54313	9/1/12	8/31/15	1	2011	None
Alpha Electric, LLC	350 Business Park Dr Sun Prairie, WI 53590	8/1/15	7/31/18	4	2014	None
Arnie Christiansen Mason Contractors, LLC	2304 65 th Dr Franksville, WI 53126	9/1/14	8/31/16	1, 2 and 4	2011	None
Atkins, Scott	See, Freedom Insulation, Inc					
Bickel, Matthew	See, Peshtigo Asphalt, Inc					
Boecker, Roger	See, R-Way Pumping, Inc					
Brechtel, Mark G	See, Ecodec, Inc					

<u>Name of Contractor</u>	<u>Address</u>	<u>Effective Date</u>	<u>Termination Date</u>	<u>Cause Code</u>	<u>Date of Violation(s)</u>	<u>Limitations/ Deviations</u>
Cargill Heating and Air Conditioning Company, Inc	3049 Edgewater La La Crosse, WI 54603	3/1/14	2/28/17	1 and 2	2011	None
Castlerock Commercial Construction, Inc	PO Box 11699 Milwaukee, WI 53211-0699	2/1/12	1/31/15	1, 2 and 4	2009 & 2010	None
Christiansen, Andy	See, Arnie Christiansen Mason Contractors, LLC					
Christiansen, Arnold	See, Arnie Christiansen Mason Contractors, LLC					
Darnick, Gregory L	See, Darnick Trucking, LLC					
Darnick Trucking, LLC	W914 County Rd V Berlin, WI 54923	11/1/14	10/31/15	1, 2 and 4	2012 & 2013	None
Dem/Ex Group, Inc	805 S Adams St Manito, IL 61546	12/1/11	11/30/14	1 and 2	2010	None
Duran, Bernardo	See, A-1 Duran Roofing & Insulation Services and RRS2 Inc					
Ecodec, Inc	5106 Wintergreen Dr Madison, WI 53704	10/1/14	9/30/17	1	2011 & 2012	None
Fisher, Ed &/or Fisher, Rhonda	See, Dem/Ex Group, Inc					
Freedom Insulation, Inc	117925 219th Ave Chippewa Falls, WI 54729	9/1/11	8/31/14	1	2008- 2010	None
Froode, Kathleen M	See, Masonry Specialists II, LLC					
Galstad, Michael E (aka Michael Earl Galstad)	See, Cargill Heating and Air Conditioning Company, Inc					

<u>Name of Contractor</u>	<u>Address</u>	<u>Effective Date</u>	<u>Termination Date</u>	<u>Cause Code</u>	<u>Date of Violation(s)</u>	<u>Limitations/Deviations</u>
Gjolaj, Ded	See, Horizon Bros Painting Corp					
Grade A Construction, Inc	157 Enterprise Rd Delafield, WI 53018	1/1/16	12/31/19	1, 2 and 4	2014	None
Horizon Bros Painting Corp	1053 Kendra La Howell, MI 48843	10/1/14	9/30/16	4	2012	None
JT Roofing, Inc	350 Tower Dr Saukville, WI 53080	6/1/12	5/31/15	1, 2 and 4	2007 & 2008	None
Jinkins, Richard	See, Castlerock Commercial Construction, Inc					
John's Concrete	See, Wagner Companies, Inc, dba John's Concrete					
Kott, Joseph J	See, Alpha Electric, LLC					
Masonry Specialists II, LLC	5109 Briarwood Ct Racine, WI 53402	8/1/15	7/31/18	4	2014	None
Mid-W Enterprises, Inc	1730 22 nd Avenue Kenosha, WI 53140	6/1/15	5/31/17	1, 2 and 4	2013	None
Midwest Construction Co, Inc	See, Mid-W Enterprises, Inc					
Oden, Cassie	See, A-1 Duran Roofing & Insulation Services and RRS2 Inc					
Ofstie, Darin	See, Precision Excavating and Grading, LLC					
Peret, Robert	See, A-1 Duran Roofing & Insulation Services and RRS2 Inc					

<u>Name of Contractor</u>	<u>Address</u>	<u>Effective Date</u>	<u>Termination Date</u>	<u>Cause Code</u>	<u>Date of Violation(s)</u>	<u>Limitations/ Deviations</u>
Peshtigo Asphalt, Inc	W3895 Track La Peshtigo, WI 54157	3/1/16	2/28/17	1	2013- 2014	None
Precision Excavating and Grading, LLC or Precision Excavating Enterprises, LLC	2104 Pierce Saint Croix Rd Baldwin, WI 54002	5/1/11	4/30/14	1, 2 and 4	2006- 2008	None
R-Way Pumping, Inc	3023 Lake Maria Rd Freeport, MN 56331	3/1/12	2/28/15	1, 2 and 4	2008	None
RRS2 Inc.	133 N Jackson St, #427 Milwaukee, WI 53202 or 1313 N Franklin Pl, #805 Milwaukee, WI 53202	11/1/14	10/31/17	1, 2 and 4	2011- 2012	None
Thull, Gerald T	See, JT Roofing, Inc					
Ventura, Robert	See, Mid-W Enterprises, Inc					
Wagner, Cory L	See, Wagner Companies, Inc					
Wagner Companies, Inc, dba John's Concrete	2063 Georgia Ave Racine, WI 53404	8/1/15	7/31/18	1	2013	None
Yaresh, Kathleen R	See, Grade A Construction, Inc					

Cause Code: 1 = Failure to Pay Straight Time 2 = Failure to Pay Overtime 3 = Kickback 4 = Payroll Records.

PREVAILING WAGE – Contractors

Any public works project that has a total estimated project cost that equals or exceeds prevailing wage project thresholds requires a prevailing wage rate determination issued by the Department of Workforce Development (DWD). Public works include erecting, constructing, remodeling, repairing, demolishing, alterations, painting and decorating projects for a local governmental unit or state agency. State law excludes minor service or maintenance work, warranty work, or work under a supply-and-installation contract. There is a statutory definition for most of these exclusions. The prevailing wage laws that apply to local governmental units and their contractors are §§66.0903 and 103.503, Wis. Stats. The prevailing wage laws that apply to state agencies and their contractors are §§103.49 and 103.503, Wis. Stats. The applicable administrative rules for all prevailing wage projects are DWD 290 and DWD 294, Wis. Adm. Code. These laws include provisions that apply to all contractors and subcontractors working on prevailing wage projects.

Any contractor or subcontractor working on a local governmental unit or state agency's public works project that equals or exceeds current prevailing wage project thresholds must do all of the following:

- Receive and review the project's prevailing wage rate determination (i.e., white sheet).
- Tell subcontractors the project is subject to state prevailing wage law and include the prevailing wage rate determination in the construction contract, or if there is no written contract, provide a copy of the project determination to each subcontractor.
- Hire subcontractors who do *not* appear on the "Consolidated List of Debarred Contractors."
- Have a written substance abuse testing program in place that fulfills the requirements of §103.503, Wis. Stats., before commencing work on the project.

- Notify subcontractors that if DWD finds that a contractor or subcontractor violated the prevailing wage law, DWD will assess liquidated damages of 100% of the wages owed to employees.
- Apply to DWD for subjourney wage rates prior to employing these individuals on the project.
- Receive and retain a completed Affidavit of Compliance from each subcontractor brought on to the project before providing final payment to those subcontractors.
- Submit a completed Affidavit of Compliance to the contractor who brought the subcontractor on to the project before receiving final payment for the project.
- Maintain payroll records for 3 years that comply with §§66.0903(10)(a) or 103.49(5)(a), Stats. and DWD 274.06.
- Respond to requests from DWD or the project owner to provide payroll records and/or respond to prevailing wage complaints filed by employees or third parties.

For more information, visit the prevailing wage website: http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm. For further assistance, call the Equal Rights Division at 608-266-6861 and ask for prevailing wage.

Disclosure of Ownership

The statutory authority for the use of this form is prescribed in Sections 66.0903(12)(d), 66.0904(10)(d) and 103.49(7)(d), Wisconsin Statutes.

The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1) (m), Wisconsin Statutes].

- (1) On the date a contractor submits a bid to or completes negotiations with a state agency, local governmental unit, or developer, investor or owner on a project subject to Section 66.0903, 66.0904 or 103.49, Wisconsin Statutes, the contractor shall disclose to such state agency, local governmental unit, or developer, investor or owner, the name of any "other construction business," which the contractor, or a shareholder, officer or partner of the contractor, owns or has owned within the preceding three (3) years.
- (2) The term "other construction business" means any business engaged in the erection, construction, remodeling, repairing, demolition, altering or painting and decorating of buildings, structures or facilities. It also means any business engaged in supplying mineral aggregate, or hauling excavated material or spoil as provided by Sections 66.0903(3), 66.0904(2), 103.49(2) and 103.50(2), Wisconsin Statutes.
- (3) This form must **ONLY** be filed, with the state agency project owner, local governmental unit project owner, or developer, investor or owner of a publicly funded private construction project that will be awarding the contract, if **both (A) and (B) are met**.
 - (A) The contractor, or a shareholder, officer or partner of the contractor:
 - (1) Owns at least a 25% interest in the "other construction business," indicated below, on the date the contractor submits a bid or completes negotiations; or
 - (2) Has owned at least a 25% interest in the "other construction business" at any time within the preceding three (3) years.
 - (B) The Wisconsin Department of Workforce Development (DWD) has determined that the "other construction business" has failed to pay the prevailing wage rate or time and one-half the required hourly basic rate of pay, for hours worked in excess of the prevailing hours of labor, to any employee at any time within the preceding three (3) years.

Other Construction Business

Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code

I hereby state under penalty of perjury that the information, contained in this document, is true and accurate according to my knowledge and belief.

Print the Name of Authorized Officer			
Authorized Officer Signature		Date Signed	
Corporation, Partnership or Sole Proprietorship Name			
Street Address or P O Box	City	State	Zip Code

If you have any questions call (608) 266-6861

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m), Wisconsin Statutes].

State Of _____))SS County Of _____)	Project Name	
	DWD Determination Number	Project Number (if applicable)
	Date Determination Issued	Date of Contract
	Awarding Agency	
	Date Work Completed	

- **I am** the duly authorized officer of the corporation, partnership, sole proprietorship or business indicated below and have recently completed all of the work required under the terms and conditions of a contract with the above-named awarding agency and make this affidavit in accordance with the requirements set forth in Section 66.0903(9)(c), 66.0904(7)(c) or 103.49(4r)(c), Wisconsin Statutes and Chapter DWD 290 of the Wisconsin Administrative Code in order to obtain FINAL PAYMENT from such awarding agency.
- **I have** fully complied with all the wage and hour requirements applicable to this project, including all of the requirements set forth in the prevailing wage rate determination indicated above which was issued for such project by the Department of Workforce Development on the date indicated above.
- **I have** received the required affidavit of compliance from each of my agents and subcontractors that performed work on this project and have listed each of their names and addresses on page 2 of this affidavit.
- **I have** full and accurate records that clearly indicate the name and trade or occupation of every worker(s) that I employed on this project, including an accurate record of the hours worked and actual wages paid to such worker(s).
- **I will** retain the records and affidavit(s) described above and make them available for inspection for a period of at least three (3) years from the completion date indicated above at the address indicated below and shall not remove such records or affidavit(s) without prior notification to the awarding agency indicated above.

Name of Corporation, Partnership, Sole Proprietorship, Business, State Agency or Local Governmental Unit				
Street Address	City	State	Zip Code	Telephone Number
Print Name of Authorized Officer			Date Signed	
Signature of Authorized Officer				

List of Agents and Subcontractors

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

If you have any questions call (608) 266-6861

Agent or Subcontractor Affidavit of Compliance With Prevailing Wage Rate Determination

Authorization for this form is provided under Sections 66.0903(9)(b), 66.0904(7)(b) and 103.49(4r)(9b), Wisconsin Statutes. The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.

Personal information you provide may be used for secondary purposes [Privacy Law, Section 15.04(1)(m), Wisconsin Statutes].

This form must **ONLY** be filed with the **Awarding Contractor** indicated below.

State Of _____))SS County Of _____)	Project Name	
	DWD Determination Number	Project Number (if applicable)
	Date Determination Issued	Date of Subcontract
	Awarding Contractor	
	Date Work Completed	

After being duly sworn, the person whose name and signature appears below hereby states under penalty of perjury that

- **I am** the duly authorized officer of the corporation, partnership, sole proprietorship or business indicated below. We have recently completed all of the work required under the terms and conditions of a subcontract with the above-named awarding contractor. We make this affidavit in accordance with the requirements set forth in Section 66.0903(9)(b), 66.0904(7)(b) or 103.49(4r)(b), Wisconsin Statutes and Chapter DWD 290 of the Wisconsin Administrative Code in order to obtain FINAL PAYMENT from such awarding contractor.
- **I have** fully complied with the entire wage and hour requirements applicable to this project, including all of the requirements set forth in the prevailing wage rate determination indicated above which was issued for such project by the Department of Workforce Development on the date indicated above.
- **I have** received the required affidavit of compliance from each of my agents and subcontractors that performed work on this project and have listed each of their names and addresses on page 2 of this affidavit.
- **I have** full and accurate records that clearly indicate the name and trade or occupation of every worker(s) that I employed on this project, including an accurate record of the hours worked and actual wages paid to such worker(s).
- **I will** retain the records and affidavit(s) described above and make them available for inspection for a period of at least three (3) years from the completion date indicated above at the address indicated below and shall not remove such records or affidavit(s) without prior notification to the awarding contractor.

Name of Corporation, Partnership, Sole Proprietorship, Business, State Agency or Local Governmental Unit				
Street Address or PO Box	City	State	Zip Code	Telephone Number ()
Print Name of Authorized Officer			Date Signed	
Authorized Officer Signature				

List of Agents and Subcontractors

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ()			Telephone Number ()		

If you have any questions call (608) 266-6861

Request to Employ Subjourneyperson

The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes. Personal information you provide may be used for secondary purposes (Privacy Law, s. 15.04(1)(m), Wisconsin Statutes]. The employer indicated below requests that the Department of Workforce Development (DWD) determine the prevailing wage rate(s) and related qualifications to enable such employer to use a subjourneyperson(s) on the following prevailing wage project, in accordance with the provisions of Section DWD 290.025, Wisconsin Administrative Code.

1. Name of Project Appearing on the Project Determination			
County	City, Village or Town		
DWD Project Determination Number	Project Number (if applicable)		
2. Job Classification(s) for which you request a subjourney rate (i.e., carpenter, electrician, plumber, etc.)			
a.	b.		
c.	d.		
3. Employer Name (Print)			
Address		City	State Zip Code
Telephone Number ()		Requester Title	
Email address (if you prefer to receive your response via email)		Fax Number (if you prefer to receive your response via fax) ()	
READ CAREFULLY: I understand that this request is ONLY applicable to the project and job classification(s) listed above and that subjourney employees primarily work under the direction of and assist a skilled trade employee by frequently using the tools of a skilled trade and will NOT regularly perform the duties of a general laborer, heavy equipment operator or truck driver. If the subjourney employee regularly performs the work of a different trade or occupation, he/she will be compensated for such work at the applicable journeyperson prevailing wage rate. I agree to compensate subjourney employees in strict accordance with the directions received from the DWD.		Requester Signature	
		Date Signed	

MAIL the completed request to:
EQUAL RIGHTS DIVISION, LABOR STANDARDS BUREAU
PO BOX 8928, MADISON WI 53708

OR

FAX the completed request to: (608) 267-4592 / DO NOT e-mail your request.
Call (608) 266-6861 for assistance in completing this form.

ADDITIONAL GENERAL PREVAILING WAGE LAW INFORMATION

(This document updated July 2015)

NOTE: Recent prevailing wage law changes enacted by the 2015-17 Budget Bill (2015 Wisconsin Act 55) do not go into effect until calendar year 2017.

For prevailing wage laws and frequently asked questions, refer to the prevailing wage website at:
http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm

Topic	Who's affected?	Brief description of requirement under §66.0903 or §103.49
Non-applicability	All public entities	Prevailing wage rates do not apply to minor service or maintenance work, warranty work, or work under a supply and installation contract.
Non-applicability: Minor service or maintenance work	Local governmental units & Contractors	Minor service or maintenance work means a project of public works that is limited to • minor crack filling, chip or slurry sealing, or other minor pavement patching, not including overlays, that has a projected life span of no longer than 5 years or that is performed for a TOWN and is not funded under §86.31, regardless of projected life span; • the depositing of gravel on an existing gravel road applied solely to maintain the road; • road shoulder maintenance; • cleaning of drainage or sewer ditches or structures; or • any other limited, minor work on public facilities or equipment that is routinely performed to prevent breakdown or deterioration.
Non-applicability: Minor service or maintenance work	State agencies	Minor service or maintenance work means a project of public works that is limited to • minor crack filling, chip or slurry sealing, or other minor pavement patching, not including overlays, that has a projected life span of no longer than 5 years; • cleaning of drainage or sewer ditches or structures; or • any other limited, minor work on public facilities or equipment that is routinely performed to prevent breakdown or deterioration.
Non-applicability: Supply & installation contract	All public entities	Supply and installation contract means a contract under which the material is installed by means of simple fasteners or connectors such as screws or nuts and bolts and no other work is performed on the site of the project of public works, and the total labor cost to install the material does not exceed 20 percent of the total cost of the contract.
Non-applicability: Work which a contractor or individual donates to a public entity	All public entities	Prevailing wage laws §§66.0903 & 103.49, Stats., do not apply to work performed on a project of public works for which the local governmental unit or the state or the state agency contracting for the project is not required to compensate any contractor, subcontractor, contractor's or subcontractor's agent, or individual for performing the work.

Topic	Who's affected?	Brief description of requirement under §66.0903 or §103.49
Non-applicability: Residential	All public entities	A prevailing wage rate determination is not required for the erection, construction, repair, remodeling, or demolition of a residential property containing 2 dwelling units or less.
Non-applicability: Residential subdivision infrastructure	All public entities	A prevailing wage rate determination is not required for a road, street, bridge, sanitary sewer, or water main project that is a part of a development in which at least 90 percent of the lots contain or will contain 2 dwelling units or less, as determined by the local governmental unit at the time of approval of the development, and that, on completion, is acquired by, or dedicated to, a local governmental unit (including under §236.13(2), Stats.), or the state, for ownership or maintenance by the local governmental unit or the state.
Electronic certified payroll record	Contractors	The requirement that every contractor on a prevailing wage project submit to DWD monthly a certified record of employees who worked on the project and that DWD post these certified records on its Internet website was discontinued effective July 1, 2011. Contractors are still required to maintain payroll records and provide them upon request from DWD &/or the project owner.
Payroll record inspection request by any person	Contractors & Complainants	Any person may request DWD to inspect the payroll records of any contractor working on a prevailing wage project. On receipt of such a request, the contractor must submit to DWD a certified record of its payroll records, other than personally identifiable information relating to an employee of the contractor, for no longer than a 4-week period. DWD may request records from a contractor under this provision no more than once per calendar quarter for each project of public works on which the contractor is performing work. The department may not charge a requester a fee for obtaining that information. DWD must make these certified records available for public inspection.
Statewide uniformity	Local governmental units	A local governmental unit may not enact & administer a prevailing wage ordinance/provision for public works or publicly funded private construction projects. Any extant laws to that effect are void.
Substance Abuse Testing	Contractors & Workers	Before commencing work on a prevailing wage project, a contractor must have a written substance abuse testing program in place that complies with §103.503, Wis. Stats. No employee may use, possess, attempt to possess, distribute, deliver, or be under the influence of a drug or under the influence of alcohol while performing work on a prevailing wage project.

Topic	Who's affected	Brief description of requirement under §66.0903 or §103.49
Covered employees	Truck drivers & Other workers & Contractors	A laborer, worker, mechanic, or truck driver who is employed to process, manufacture, pick up, or deliver materials or products from a commercial establishment that has a fixed place of business from which the establishment supplies processed or manufactured materials or products or from a facility that is not dedicated exclusively, or nearly so, to a project of public works is NOT entitled to receive the prevailing wage rate UNLESS any of the following applies: 1) the laborer, worker, mechanic, or truck driver is employed to go to the source of mineral aggregate such as sand, gravel, or stone and deliver that mineral aggregate to the site of a project of public works by depositing the material directly in final place, from the transporting vehicle or through spreaders from the transporting vehicle. 2) the laborer, worker, mechanic, or truck driver is employed to go to the site of a project of public works, pick up excavated material or spoil from the site of the project, and transport that excavated material or spoil away from the site of the project.

General Decision Number: WI160011 05/20/2016 WI11

Superseded General Decision Number: WI20150011

State: Wisconsin

Construction Type: Building

Counties: Adams, Ashland, Barron, Bayfield, Buffalo, Burnett, Clark, Columbia, Crawford, Dodge, Door, Dunn, Florence, Fond Du Lac, Forest, Grant, Green, Green Lake, Iowa, Iron, Jackson, Jefferson, Juneau, Kewaunee, Lafayette, Langlade, Lincoln, Manitowoc, Marinette, Marquette, Menominee, Monroe, Oconto, Oneida, Pepin, Polk, Portage, Price, Richland, Rusk, Sauk, Sawyer, Shawano, Taylor, Trempealeau, Vernon, Vilas, Walworth, Washburn, Waupaca, Waushara and Wood Counties in Wisconsin.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.15 for calendar year 2016 applies to all contracts subject to the Davis-Bacon Act for which the solicitation was issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.15 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2016. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/08/2016
1	01/29/2016
2	03/04/2016
3	03/11/2016
4	04/01/2016
5	05/20/2016

ASBE0019-002 11/30/2015

COLUMBIA, CRAWFORD, DODGE, GRANT, GREEN, IOWA, JEFFERSON, JUNEAU, LAFAYETTE, MARQUETTE, MONROE, RICHLAND, SAULK, VERNON, AND WALWORTH COUNTIES

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, protective coverings, coatings, and finishes to all types of mechanical systems).....	\$ 33.83	28.25

ASBE0034-005 06/01/2015

BARRON, BUFFALO, DUNN, AND POLK COUNTIES

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials; protective coatings, coverings, and finishes to all types of mechanical systems. Does not include asbestos removal).....	\$ 34.37	28.68

ASBE0049-003 06/01/2015

ASHLAND, BAYFIELD, BURNETT, IRON, PEPIN, SAWYER, AND WASHBURN COUNTIES

	Rates	Fringes

Asbestos Workers/Insulator (Includes the application of all insulating materials; protective coverings, coatings, and finishes to all types of mechanical systems).....	\$ 27.82	24.15

ASBE0127-002 06/01/2015

ADAMS, CLARK, DOOR, FLORENCE, FOND DU LAC, FOREST, GREEN LAKE,
JACKSON, KEWAUNEE, LINCOLN, MANITOWOC, MARINETTE, MENOMINEE,
OCONTO, ONEIDA, PORTAGE, PRICE, RUSK, SHAWANO, TAYLOR,
TREMPEALEAU, VILAS, WAUPACA, WAUSHARA, AND WOOD COUNTIES

	Rates	Fringes

Heat and Frost Insulator (Includes the application of all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems; and the application of firestopping material in walls, floors, ceilings).....	\$ 30.34	21.13

ASBE0205-005 06/01/1998

ADAMS, CLARK, DOOR, FLORENCE, FOND DU LAC, FOREST, GREEN LAKE,
JACKSON, KEWAUNEE, LANGLADE, LINCOLN, MANITOWOC, MARINETTE,
MENOMINEE, OCONTO, ONEIDA, PORTAGE, PRICE, RUSK, SHAWANO,
TAYLOR, TREMPPEALEAU, VILAS, WAUPACA, WAUSHARA, AND WOOD COUNTIES

	Rates	Fringes

Asbestos Removal worker/hazardous material handler (Includes preparation, wetting, stripping, removal, scrapping vacuuming, bagging and disposing of all insulation materials from mechanical systems whether they contain asbestos or not).....	\$ 16.56	3.10

ASBE0205-008 06/01/1999

COLUMBIA, CRAWFORD, DODGE, GRANT, GREEN, IOWA, JEFFERSON,
JUNEAU, LAFAYETTE, MARQUETTE, MONROE, RICHLAND, SAULK, VERNON,
AND WALWORTH COUNTIES

	Rates	Fringes

Asbestos Removal worker/hazardous material handler (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not)...	\$ 16.55	3.45

ASBE0205-012 05/01/1998

ASHLAND, BAYFIELD, BURNETT, IRON, PEPIN, SAWYER, AND WASHBURN
COUNTIES

	Rates	Fringes

HAZARDOUS MATERIAL HANDLER (Includes preparation,		

wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not)...	\$ 19.72	3.69

ASBE0205-013 05/01/1998

BARRON, BUFFALO, AND POLK COUNTIES

	Rates	Fringes
Asbestos Removal worker/hazardous material handler (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems whether they contain asbestos or not)...	\$ 19.72	3.69

BOIL0107-001 01/01/2015

	Rates	Fringes
BOILERMAKER Boilermaker.....	\$ 33.35	28.60
Small Boiler Repair (under 25,000 lbs/hr).....	\$ 26.91	16.00

BRWI0001-003 06/01/2015

CRAWFORD, JUNEAU, MONROE, TREMPEALEAU, AND VERNON COUNTIES

	Rates	Fringes
Bricklayer & Tile Setter.....	\$ 31.22	16.69

BRWI0002-003 06/01/2015

ASHLAND, BURNETT, IRON, WASHBURN

	Rates	Fringes
BRICKLAYER Bricklayer, Tile Setter.....	\$ 36.10	16.13
Cement Mason/Concrete Finisher.....	\$ 34.30	16.13

BRWI0002-004 06/01/2015

BAYFIELD COUNTY

	Rates	Fringes
BRICKLAYER Bricklayer & Tile Setter....	\$ 36.10	16.13

BRWI0003-001 06/01/2015

DOOR, KEWAUNEE, FLORENCE, FOND DU LAC, GREEN LAKE, MANITOWOC,
MARINETTE, MARQUETTE, OCONTO, SHAWANO, WAUPACA, AND WAUSHARA
COUNTIES

	Rates	Fringes
BRICKLAYER Bricklayer, Cement Mason, Tile Setter.....	\$ 31.59	16.39

BRWI0004-003 06/01/2013

WALWORTH COUNTY

	Rates	Fringes
BRICKLAYER.....	\$ 35.11	18.58

CEMENT MASON/CONCRETE FINISHER...	\$ 32.36	18.58
TILE SETTER.....	\$ 28.21	18.58

BRWI0006-001 06/01/2013		
ADAMS, CLARK, FOREST, LANGLADE, LINCOLN, MENOMINEE, ONEIDA, PORTAGE, TAYLOR, VILAS AND WOOD COUNTIES		
	Rates	Fringes
BRICKLAYER		
Bricklayer, Cement		
Mason, Tile Setter.....	\$ 32.14	16.56

BRWI0006-004 06/01/2013		
PRICE COUNTY		
	Rates	Fringes
Bricklayer & Tile Setter.....	\$ 32.14	16.56

BRWI0007-003 06/01/2015		
GREEN AND LAFAYETTE COUNTIES		
	Rates	Fringes
Bricklayer & Tile Setter.....	\$ 32.90	17.01

BRWI0013-003 06/01/2015		
GRANT, IOWA, AND RICHLAND COUNTIES		
	Rates	Fringes
Bricklayer.....	\$ 32.86	17.22
Tile Layer.....	\$ 29.71	16.20

BRWI0019-004 06/01/2015		
BARRON, BURNETT (Southern half), DUNN, PEPIN, POLK, RUSK, AND WASHBURN (Southern half) COUNTIES		
	Rates	Fringes
BRICKLAYER		
Bricklayer, Cement Mason,		
Tile Layer.....	\$ 31.36	16.51

BRWI0019-005 06/01/2015		
SAWYER COUNTY		
	Rates	Fringes
Bricklayer & Tile Setter.....	\$ 31.36	16.51

BRWI0021-001 06/01/2015		
DODGE AND JEFFERSON COUNTIES		
	Rates	Fringes
BRICKLAYER		
Bricklayer, Cement Mason,		
Tile Layer.....	\$ 33.58	16.65

BRWI0034-001 06/01/2015		
COLUMBIA AND SAUK COUNTIES		
	Rates	Fringes
BRICKLAYER		
Bricklayer, Cement Mason,		
Tile Layer.....	\$ 32.86	17.22

CARP0087-003 05/01/2009		

BURNETT (West of highway 48) AND POLK(West of Highways 35, 48 & 65) COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall Hanging, Acoustical work).....	\$ 31.79	16.10

CARP0252-005 07/02/2012		

ADAMS, BARRON, BAYFIELD (Eastern 2/3), BUFALO, BURNETT (East of Hwy 48), CLARK, COLUMBIA, CRAWFORD, DODGE, DOOR, DUNN, FLORENCE (Except area bordering Michigan), FOND DU LAC, FOREST, GRANT, GREEN, GREEN LAKE, IOWA, IRON, JACKSON, JEFFERSON, KEWAUNEE, LAFAYETTE, MANITOWOC, MARINETTE (Except N.E. corner), MARQUETTE, MENOMINEE, MONROE, OCONTO, ONEIDA, POLK (East of Hwy 35, 48, 65), PORTAGE, PRICE, RICHLAND, RUSK, SAUK, SAWYER, SHAWANO, TAYLOR, TREMPLEAU, VERNON, VILAS, WALWORTH, WASHBURN, WAUPACA, WAUSHARA, AND WOOD COUNTIES

	Rates	Fringes
CARPENTER (Including Drywall Hanging, Acoustical work).....	\$ 30.48	15.80
MILLWRIGHT.....	\$ 32.11	15.80

CARP0252-009 07/02/2012		

ASHLAND COUNTY

	Rates	Fringes
CABINET INSTALLER (Including Drywall Hanging & Acoustical Work).....	\$ 30.48	05.80
MILLWRIGHT.....	\$ 32.11	15.80

CARP0361-006 07/11/2011		

BAYFIELD COUNTY (West of Hwy 63)

	Rates	Fringes
Carpenters: (Including Drywall Hanging, Acoustical work).....	\$ 27.20	14.75

CARP1348-006 05/03/2015		

BAYFIELD COUNTY (Western 1/3)

	Rates	Fringes
MILLWRIGHT.....	\$ 32.57	14.73

ELEC0014-001 06/01/2015		

ASHLAND, BARRON, BAYFIELD, BUFFALO, BURNETT, CHIPPEWA, CLARK (Except Colby, Fremont, Lynn, Maryville, Sherman, Sherwood, Unity), CRAWFORD, DUNN, GRANT, IRON, JACKSON, MONROE, PEPIN, POLK, PRICE, RICHLAND, RUSK, SAWYER, TAYLOR, TREMPLEAU, VERNON, AND WASHBURN COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 31.21	18.92

ELEC0014-005 06/01/2014		

	Rates	Fringes
Teledata System Installer Installer/Technician.....	\$ 22.50	12.72
Low voltage construction, installation, maintenance and removal of teledata facilities (voice, data, and video) including outside plant, telephone and data inside wire,		

interconnect, terminal equipment, central offices, PABX, fiber optic cable and equipment, micro waves, V-SAT, bypass, CATV, WAN (wide area networks), LAN (local area networks), and ISDN (integrated systems digital network).

ELEC0158-007 06/01/2015

DOOR, KEWAUNEE, MANITOWOC (except Schleswig), MARINETTE (Wausaukee and area South thereof), OCONTO, MENOMINEE (East of a line 6 miles West of the West boundary of Oconto County), SHAWANO (Except Area North of Townships of Aniwa and Hutchins) COUNTIES

	Rates	Fringes
Electricians:.....	\$ 29.84	29.50% + 9.37

ELEC0159-001 06/01/2015

COLUMBIA, DODGE (West of Hwy 26 except Chester and Emmet Twps), GREEN LAKE COUNTY (Except Townships of Berlin, Seneca & St. Marie), IOWA, MARQUETTE COUNTY (Except Townships of Neshkoka, Crystal Lake, Newton, and Springfield), AND SAUK COUNTIES

	Rates	Fringes
Electricians:.....	\$ 35.75	19.87

ELEC0219-006 06/01/2015

FLORENCE COUNTY (Townships of Aurora, Commonwealth, Fern, Florence and Homestead) AND MARINETTE COUNTY (Township of Niagara)

	Rates	Fringes
ELECTRICIAN		
Electrical contracts over \$180,000.....	\$ 31.16	18.34
Electrical contracts under \$180,000.....	\$ 28.96	18.26

ELEC0388-004 06/01/2013

ADAMS, CLARK (Colby, Freemont, Lynn, Mayville, Sherman, Sherwood, Unity), FOREST, JUNEAU, LANGLADE, LINCOLN, MARINETTE (Beecher, Dunbar, Goodman & Pembine), MENOMINEE (Area West of a line 6 miles West of the West boundary of Oconto County), ONEIDA, PORTAGE, SHAWANO (Aniwa and Hutchins), VILAS AND WOOD COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 28.96	24.85% + 9.70

ELEC0494-010 06/01/2015

DODGE COUNTY (Area East of Hwy 26 including all of Chester Township, but excluding Emmet Township), FOND DU LAC (except Waupun), AND MANITOWOC (Schleswig) COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 29.95	20.95

ELEC0494-014 06/01/2015

DODGE (Area East of Hwy 26 including Chester Twp but excluding Emmet Twp), FOND DU LAC (Except Waupun), AND MANITOWOC (Schleswig) COUNTIES

	Rates	Fringes

Sound & Communications

Installer.....	\$ 16.47	14.84
Technician.....	\$ 26.00	17.70

Installation, testing, maintenance, operation and servicing of all sound, intercom, telephone interconnect, closed circuit TV systems, radio systems, background music systems, language laboratories, electronic carillon, antenna distribution systems, clock and program systems and low-voltage systems such as visual nurse call, audio/visual nurse call systems, doctors entrance register systems. Includes all wire and cable carrying audio, visual, data, light and radio frequency signals. Includes the installation of conduit, wiremold, or raceways in existing structures that have been occupied for six months or more where required for the protection of the wire or cable, but does not mean a complete conduit or raceway system. work covered does not include the installation of conduit, wiremold or any raceways in any new construction, or the installation of power supply outlets by means of which external electric power is supplied to any of the foregoing equipment or products

ELEC0577-001 06/01/2015

GREEN LAKE (N. Part including Twps of Berlin, St Marie, and Seneca), MARQUETTE (N. part including Twps of Crystal Lake, Neshkoro, Newton, and Springfield), WAUPACA, AND WAUSHARA COUNTIES,

	Rates	Fringes
ELECTRICIAN.....	\$ 29.60	26.5%+9.15

ELEC0890-005 06/01/2015

DODGE (Emmet Township only), GREEN, JEFFERSON, LAFAYETTE, AND WALWORTH COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 31.90	24.95% + \$10.46

ENGI0139-004 06/01/2015

	Rates	Fringes
OPERATOR: Power Equipment		
(1) Cranes, Tower Cranes with or w/o attachments over 100 tons; Cranes, tower Cranes with boom, leads and or jib length 176 ft or longer.....	\$ 37.67	20.10
(2) Cranes, Tower Cranes with or w/o attachments 100 tons or less; Cranes, Tower Cranes with boom, leads, and or jib lengths 175 ft or less.....	\$ 36.42	20.10
(3) Travelling Crane (bridge type).....	\$ 35.22	20.10
(4) Hydraulic Crane, 10 tons or less.....	\$ 34.69	20.10
(6) Forklift.....	\$ 31.99	20.10

HAZARDOUS WASTE PREMIUMS:
EPA Level "A" Protection: \$3.00 per hour
EPA Level "B" Protection: \$2.00 per hour
EPA Level "C" Protection: \$1.00 per hour

IRON0008-012 06/01/2014

CALUMET, DOOR, FOND DU LAC, KEWAUNEE, MANITOWOC, MARINETTE, OCONTO, OUTAGAMI, SHAWANO AND WALWORTH (Northeastern part) COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 29.27	23.96

Paid Holidays: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day & Christmas Day.

IRON0383-004 06/01/2015

ADAMS, COLUMBIA, CRAWFORD, DODGE, FLORENCE, FOREST, GRANT, GREENE (Except S.E. tip), GREEN LAKE, IOWA, JEFFERSON, JUNEAU, LAFAYETTE, LANGLADE, MARATHON, MARQUETTE, MENOMINEE, MONROE, PORTAGE, RICHLAND, SAUK, VERNON, WAUPACA, WAUSHARA, AND WOOD COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 32.85	21.84

IRON0498-007 06/01/2008

GREEN (S.E. 1/3) AND WALWORTH (Except N.E. part) COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 34.34	25.72

IRON0512-009 05/01/2015

BARRON, BUFFALO, CLARK, DUNN, JACKSON, PEPIN, POLK, RUSK, TAYLOR AND TREMPLEAU COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 35.50	23.45

IRON0512-023 05/01/2015

ASHLAND, BAYFIELD, BURNETT, IRON, LINCOLN, ONEIDA, PRICE, SAWYER, VILAS AND WASHBURN COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 31.04	23.45

LAB00140-003 06/01/2015

BUFFALO, CRAWFORD, GRANT, JACKSON, JUNEAU, MONROE, RICHLAND, TREMPLEAU (Southern part), AND VERNON COUNTIES

	Rates	Fringes
Laborer, General.....	\$ 25.81	15.55
Laborer: Asbestos/hazardous material remover (Preparation, Removal and Encapsulation of Hazardous Materials from Non-Mechanical Systems).....	\$ 24.92	15.55

NOTE: Mason Tender \$.25 over general laborer scale; Pipelayer \$1.00 over general laborer scale

LAB00268-001 06/01/2015

AREA 1: BARRON, CLARK (West 1/3), DUNN, PEPIN, POLK, RUSK TAYLOR (West 1/3)

AREA 2: CLARK (East 2/3), LANGLADE, LINCOLN, ONEIDA, PRICE, TAYLOR (East 2/3), VILAS, WOOD

AREA 3: BURNETT, IRON, SAWYER, WASHBURN

	Rates	Fringes

Laborer, General		
Area 1.....	\$ 25.81	15.55
Area 2.....	\$ 25.06	15.55
Area 3.....	\$ 24.21	15.55
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous materials from Non-mechanical Systems)		
Area 1.....	\$ 25.02	15.55
Area 2.....	\$ 24.47	15.55
Area 3.....	\$ 25.67	15.55

NOTE: Mason Tender \$.25 over general laborer. Burnett, Iron, Sawyer & Washburn \$.70 over general laborer.

LAB00330-001 06/01/2015

DODGE, DOOR, FLORENCE, FOND DU LAC, FOREST, GREEN LAKE, KEWAUNEE, MANITOWOC, MARINETTE, MARQUETTE, MENOMINEE, OCONTO, PORTAGE, SHAWANO, WAUPACA, WAUSHARA

	Rates	Fringes

Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous materials from Non-mechanical Systems).....	\$ 24.47	15.55
Laborers, General.....	\$ 25.06	15.55

NOTE: Mason Tender \$.25 over general laborer.

LAB00464-005 06/01/2015

ADAMS, COLUMBIA, GREEN, JEFFERSON, LAFAYETTE, SAUK, AND WALWORTH COUNTIES

	Rates	Fringes

Laborer, General		
Adams County.....	\$ 25.06	15.55
Remaining Area.....	\$ 25.81	15.55
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous Materials from Non-mechanical Systems)		
Adams County.....	\$ 24.47	15.55
Remaining Area.....	\$ 24.47	15.55

LAB00464-008 06/01/2015

	Rates	Fringes

Landscape Laborer.....	\$ 14.33	13.90

LAB01091-001 06/01/2015

BAYFIELD (West of County Trunk A including the Iron River National Fish Hatchery and Great Lakes Transmission Co., Station 6) COUNTY

	Rates	Fringes

Laborer, General.....	\$ 22.91	15.55
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous materials from Non-mechanical Systems).....	\$ 22.91	15.55

LAB01091-002 06/01/2015

ASHLAND & BAYFIELD (East of County Trunk A exclusive of the
Iron River National Fish Hatchery and Great Lakes Transmission
Co., Station 6) COUNTIES

	Rates	Fringes
Laborer, General.....	\$ 22.91	15.55
Laborer: Asbestos/hazardous material remover (Preparation, Removal, Encapsulation of Hazardous materials from Non-mechanical Systems).....	\$ 22.91	15.55

PLAS0599-003 07/01/2012

PEPIN COUNTY

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 27.80	18.10
PLASTERER.....	\$ 31.56	18.18

PLAS0599-007 06/01/2013

BUFFALO, CRAWFORD, JACKSON, JUNEAU, MONROE, POLK, RICHLAND,
TREMPEALEAU, AND VERNON COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 25.85	18.10
PLASTERER.....	\$ 29.67	17.03

PLAS0599-011 06/01/2014

GRANT, GREEN, IOWA, AND LAFAYETTE COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 33.15	16.78
PLASTERER.....	\$ 33.15	16.78

PLAS0633-046 05/01/2012

BAYFIELD, PRICE, AND SAWYER COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 29.69	16.30
PLASTERER.....	\$ 30.32	17.05

* PLUM0011-009 05/02/2016

ASHLAND BAYFIELD, BURNETT, IRON, SAWYER, AND WASHBURN COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work).....	\$ 39.07	18.73

PLUM0075-006 06/01/2015

DODGE (Watertown), GREEN, JEFFERSON, AND LAFAYETTE COUNTIES

	Rates	Fringes
PLUMBER (Including HVAC work)....	\$ 39.87	20.12

PLUM0075-008 06/01/2015

COLUMBIA, IOWA, MARQUETTE, RICHLAND, AND SAUK COUNTIES

	Rates	Fringes
PLUMBER (Including HVAC work)....	\$ 38.82	20.12

PLUM0118-003 06/01/2015

WALWORTH COUNTY

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work).....	\$ 39.20	19.25

PLUM0400-002 06/01/2015

ADAMS, CALUMET, DODGE (Except Watertown), DOOR, FOND DU LAC, GREEN LAKE, KEWAUNEE, MANITOWOC, MARINETTE (Except Niagara), MENOMINEE, OCONTO, OUTAGAMIE, SHAWANO, WAUPACA, WAUSHARA, AND WINNEBAGO COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work)		
(1) Small buildings (except industrial and power plants) where plumbing or heating is \$50,000 or less.....	\$ 31.23	17.02
(2) All other work.....	\$ 33.64	17.20

PLUM0434-004 05/31/2015

BARRON, BUFFALO, CLARK, CRAWFORD, DUNN, FLORENCE, FOREST, GRANT, JACKSON, JUNEAU, LANGLADE, LINCOLN, MONROE, ONEIDA, PEPIN, PIERCE, POLK, PORTAGE, PRICE, RUSK, TAYLOR, TREMPLEAU, VERNON, VILAS, AND WOOD COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work).....	\$ 36.75	16.32

PLUM0601-006 06/01/2015

DODGE (Watertown), GREEN, JEFFERSON, AND LAFAYETTE COUNTIES

	Rates	Fringes
PIPEFITTER (Including HVAC work).....	\$ 42.36	21.64

PLUM0601-008 06/01/2015

COLUMBIA, IOWA, MARQUETTE, RICHLAND, AND SAUK COUNTIES

	Rates	Fringes
PIPEFITTER (Including HVAC work).....	\$ 45.55	18.44

SHEE0010-031 05/01/2008

ASHLAND, BAYFIELD AND IRON COUNTIES

	Rates	Fringes
SHEET METAL WORKER.....	\$ 27.53	14.61

SHEE0018-003 06/01/2011

FOND DU LAC AND MANITOWOC COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 31.88	17.40

SHEE0018-004 06/01/2015

ADAMS, DOOR, FLORENCE, FOREST, GREEN LAKE, KEWAUNEE, MARINETTE, MARQUETTE, MENOMINEE, OCONTO, SHAWANO, WAUPACA, AND WAUSHARA

COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 30.82	21.85

SHEE0018-014 06/01/2011		

DODGE AND JEFFERSON COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 37.20	17.01

SHEE0018-015 09/01/2010		

WALWORTH COUNTY

	Rates	Fringes
SHEET METAL WORKER (Including HVAC work).....	\$ 31.85	22.50

SHEE0018-017 06/01/2011		

GREEN COUNTY

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 32.75	20.36

SHEE0018-018 06/01/2015		

LANGLADE, LINCOLN, ONEIDA, PORTAGE, AND WOOD COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work)		
Contracts \$120,000 or less..	\$ 20.57	11.60
Contracts over \$120,000.....	\$ 28.36	24.59

SHEE0018-022 06/01/2015		

BARRON, BUFFALO, BURNETT, CLARK, DUNN, JACKSON, PEPIN, POLK, PRICE, RUSK, SAWYER, TAYLOR, TREMPLEAU, AND WASHBURN COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 28.63	23.79

SHEE0018-023 06/01/2015		

COLUMBIA AND SAUK COUNTIES

	Rates	Fringes
Sheet Metal Worker (Including HVAC work).....	\$ 35.55	24.61

SHEE0018-024 06/01/2015		

CRAWFORD, GRANT, JUNEAU, MONROE, RICHLAND, AND VERNON COUNTIES

	Rates	Fringes
SHEET METAL WORKER (Including HVAC work).....	\$ 28.75	21.62

TEAM0346-003 05/01/2013		

ASHLAND, BAYFIELD, BURNETT, SAWYER & WASHINGTON COUNTIES

Rates	Fringes

TRUCK DRIVER
 2 Axle Trucks.....\$ 27.42 14.986

 TEAM0662-002 06/01/2015

ADAMS, BARRON, BUFFALO, CLARK, DOOR, DUNN, JACKSON, JUNEAU,
 KEWAUNEE, LANGLADE, LINCOLN, MANITOWOC, MENOMINEE, OCONTO,
 ONEIDA, PEPIN, POLK, PORTAGE, PRICE, RUSK, SHAWANO, TAYLOR,
 TEMPEALEAU, WAUPACA & WOOD COUNTIES

	Rates	Fringes
TRUCK DRIVER		
2 Axle Trucks.....	\$ 27.46	15.9775

SUWI2002-001 01/23/2002		

	Rates	Fringes
Fence Installers.....	\$ 15.00	2.37
GLAZIER.....	\$ 20.21	1.86
Painters:		
Brush & Roller (Excluding		
Drywall Finishing).....	\$ 14.64	2.55
Spray.....	\$ 13.72	2.25
Power Equipment Operator		
Backhoe.....	\$ 17.454	7.61
Excavator.....	\$ 17.37	7.45
Front End Loader.....	\$ 23.36	4.61
ROOFER.....	\$ 15.52	3.21
TRUCK DRIVER (3-Axle).....	\$ 15.28	4.78

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

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

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

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed
 in dotted lines beginning with characters other than "SU" or
 "UAVG" denotes that the union classification and rate were
 prevailing for that classification in the survey. Example:
 PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of
 the union which prevailed in the survey for this
 classification, which in this example would be Plumbers. 0198
 indicates the local union number or district council number
 where applicable, i.e., Plumbers Local 0198. The next number,
 005 in the example, is an internal number used in processing
 the wage determination. 07/01/2014 is the effective date of the
 most current negotiated rate, which in this example is July 1,
 2014.

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

this classification and rate.

Survey Rate Identifiers

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

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

Union Average Rate Identifiers

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

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

WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

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

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

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

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

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

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

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

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END OF GENERAL DECISION

General Decision Number: WI160003 03/04/2016 WI3

Superseded General Decision Number: WI20150003

State: Wisconsin

Construction Type: Building

County: La Crosse County in Wisconsin.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.15 for calendar year 2016 applies to all contracts subject to the Davis-Bacon Act for which the solicitation was issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.15 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2016. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/08/2016
1	01/29/2016
2	03/04/2016

ASBE0205-001 06/01/2001

	Rates	Fringes
Asbestos Removal worker/hazardous material handler		
Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not.....	\$ 17.90	4.45

BOIL0107-001 01/01/2015

	Rates	Fringes
BOILERMAKER		
Boilermaker.....	\$ 33.35	28.60
Small Boiler Repair (under 25,000 lbs/hr).....	\$ 26.91	16.00

BRWI0001-004 06/01/2015

	Rates	Fringes
Bricklayer & Tile Setter.....	\$ 31.22	16.69

CARP0252-001 07/02/2012

	Rates	Fringes
CARPENTER (Including Drywall Hanging, Acoustical work, Excluding Batt Insulation)		
CARPENTER & SOFT FLOOR LAYER.....	\$ 30.48	15.80
MILLWRIGHT.....	\$ 32.11	15.80
PILEDRIVERMAN.....	\$ 30.98	15.80

ELEC0014-004 06/01/2015

	Rates	Fringes

ELECTRICIAN.....\$ 31.21 18.92

ELEC0014-005 06/01/2014

Rates Fringes

Teledata System Installer
Installer/Technician.....\$ 22.50 12.72

Low voltage construction, installation, maintenance and removal of teledata facilities (voice, data, and video) including outside plant, telephone and data inside wire, interconnect, terminal equipment, central offices, PABX, fiber optic cable and equipment, micro waves, V-SAT, bypass, CATV, WAN (wide area networks), LAN (local area networks), and ISDN (integrated systems digital network).

ELEV0132-001 01/01/2015

Rates Fringes

ELEVATOR MECHANIC.....\$ 46.83 28.385

FOOTNOTE:

PAID VACATION: Employer contributes 8% of basic hourly rate as vacation pay for employees with more than 5 years or more of service, and 6% for less than 5 years of service.
PAID HOLIDAYS: New Years Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

ENGI0139-002 06/01/2015

Rates Fringes

OPERATOR: Power Equipment
Group 1.....\$ 37.67 20.10
Group 2.....\$ 36.42 20.10
Group 3.....\$ 35.22 20.10
Group 4.....\$ 34.69 20.10
Group 5.....\$ 32.62 20.10
Group 6.....\$ 31.99 20.10

HAZARDOUS WASTE PREMIUMS:

EPA Level "A" Protection: \$3.00 per hour
EPA Level "B" Protection: \$2.00 per hour
EPA Level "C" Protection: \$1.00 per hour

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Cranes, Tower Cranes and Derricks with or without attachments with a lifting capacity of over 100 tons; Cranes, Tower Cranes, and Derricks with boom, leads and/or jib lengths 176 ft or longer.

GROUP 2: Backhoes (Excavators) weighing 130,000 lbs & over; Cranes, Tower Cranes and Derricks with or without attachments with a lifting capacity of 100 tons or less; Cranes, Tower Cranes, and Derricks with boom, leads, and/or jib lengths 175 ft or less; Caisson Rigs; Pile Driver

GROUP 3: Backhoes (Excavators) weighing under 130,000 lbs; Travelling Crane (bridge type); Milling Machine; Concrete Paver over 27 E; Concrete Spreader and Distributor; Concrete Laser Screed; Concrete Grinder and Planing Machine; Slipform Curb and Gutter Machine; Boring Machine (Directional); Dredge Operator; Skid Rigs; Over 46 meter Concrete Pump.

GROUP 4: Hydraulic Backhoe (tractor or truck mounted); Hydraulic Crane, 10 tons or less; Tractor, Bulldozer, or End Loader (over 40 hp); Motor Patrol; Scraper Operator; Bituminous Plant and Paver Operator; Screed-Milling Machine; Roller over 5 tons; Concrete Pumps 46 meter & under; Grout Pumps; Rotec Type Machine; Hydro Blaster, 10,000 psi and over; Rotary Drill Operator; Percussion Drilling Machine; Air Track Drill with or without integral hammer; Blaster; Boring Machine (vertical or horizontal);

Side Boom; Trencher, wheel type or chain type having 8 inch or larger bucket; Rail Leveling Machine (Railroad); Tie Placer; Tie Extractor; Tie Tamper; Stone Leveler; Straddle Carrier; Material Hoists; Stack Hoist; Man Hoists; Mechanic and Welder; Off Road Maaerial Haulers

GROUP 5: Tractor, Bulldozer, or Endloader (under 40 hp); Tampers -Compactors, riding type; Stump Chipper, large; Roller, Rubber Tire; Backfiller; Trencher, chain type (bucket under 8 inch); Concrete Auto Breaker, large; Concrete Finishing Machine (road type); Concrete Batch Hopper; Concrete Conveyor Systems; Concrete Mixers, 14S or over; Pumps, Screw Type and Gypsum); Hydrohammers, small; Brooms and Sweepers; Lift Slab Machine; Roller under 5 tons; Industrial Locomotives; Fireman (Pile Drivers and Derricks); Pumps (well points); Hoists, automatic; A-Frames and Winch Trucks; Hoists (tuggers); Boats (Tug, Safety, Work Barges and Launches); Assistant Engineer

GROUP 6: Shouldering Machine Operator; Farm or Industrial Tractor mounted equipment; Post Hole Digger; Auger (vertical and horizontal); Skid Steer Loader with or without attachments; Robotic Tool Carrier with or without attachments; Power Pack Vibratory/Ultra Sound Driver and Extractor; Fireman (Asphalt Plants); Screed Operator; Stone Crushers and Screening Plants; Air, Electric, Hydraulic Jacks (Slip Form); Prestress Machines; Air Compressor, 400 CFM or over; Refrigeration Plant/Freeze Machine; Boiler Operators (temporary heat); Forklifts; Welding Machines; Generators; Pumps over 3"; Compressors, under 400 CFM; Heaters, Mechanical; Combination small equipment operator; Winches, small electric; Oiler; Greaser; Rotary Drill Tender; Conveyor; Elevator Operator

IRON0383-002 06/01/2015

	Rates	Fringes
IRONWORKER.....	\$ 32.85	21.84

LAB00140-001 06/01/2015

	Rates	Fringes
Laborer, General.....	\$ 25.81	15.55
Laborer: Asbestos/hazardous material remover (Preparation, Removal and Encapsulation of Hazardous Materials from Non-Mechanical Systems).....	\$ 24.92	15.55

NOTE: Mason Tender \$.25 over general laborer scale; Pipelayer \$1.00 over general laborer scale

PAIN0259-005 05/01/2015

	Rates	Fringes
PAINTER.....	\$ 22.03	12.45

PLAS0599-006 07/01/2012

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 25.85	18.10
PLASTERER.....	\$ 31.56	18.18

PLUM0434-001 05/31/2015

	Rates	Fringes
PLUMBER/PIPEFITTER (Including HVAC work).....	\$ 36.75	16.32

* SFWI0669-002 01/01/2016

Rates	Fringes

SPRINKLER FITTER.....	\$ 38.28	19.36

SHEE0018-008 06/01/2015		
	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct work and Technicians).....	\$ 28.75	21.62

TEAM0662-003 06/01/2015		
	Rates	Fringes
TRUCK DRIVER		
1 & 2 Axles.....	\$ 27.46	15.9775
3 or more Axles.....	\$ 27.46	15.9775

SUWI2002-004 01/23/2002		
	Rates	Fringes
Asbestos Worker/Heat and Frost Insulator.....	\$ 25.36	8.37
Laborers:		
Concrete Workers.....	\$ 16.34	3.59
Landscape.....	\$ 8.73	4.90
ROOFER.....	\$ 18.01	3.28
Tile & Marble Finisher.....	\$ 13.89	8.33

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

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

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

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

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

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that

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

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

Union Average Rate Identifiers

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

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

WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

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

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

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

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

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

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

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

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END OF GENERAL DECISION

FEBRUARY 1999

**NOTICE TO BIDDERS
WAGE RATE DECISION**

The wage rate decision of the Secretary of Labor which has been incorporated in these advertised specifications is incomplete in that the classifications may be omitted from the Secretary of Labor's decision.

Since the bidder is responsible, independently, for ascertaining area practice with respect to the necessity, or lack of necessity, for the use of these classifications in the prosecution of the work contemplated by this project, no inference may be drawn from the omission of these classifications concerning prevailing area practices relative to their use. Further, this omission will not, per se, be construed as establishing any governmental liability for increased labor cost if it is subsequently determined that such classifications are required.

There may be omissions and/or errors in the federal wage rates. The bidder is responsible for evaluating and determining the correct applicable rate. The higher of state or federal rate will apply.

Wisconsin Department of Transportation

PAGE: 1

DATE: 05/31/16

SCHEDULE OF ITEMS

REVISED:

CONTRACT:
20160712003PROJECT(S):
1070-00-72
1070-00-73FEDERAL ID(S):
WISC 2016246
WISC 2016247

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS

SECTION 0001 Contract Items

0010	201.0115 Clearing	25.000	ACRE	.	.
0020	201.0215 Grubbing	25.000	ACRE	.	.
0030	203.0100 Removing Small Pipe Culverts	1.000	EACH	.	.
0040	204.0100 Removing Pavement	16,160.000	SY	.	.
0050	204.0155 Removing Concrete Sidewalk	100.000	SY	.	.
0060	204.0170 Removing Fence	4,450.000	LF	.	.
0070	204.0180 Removing Delineators and Markers	17.000	EACH	.	.
0080	204.0195 Removing Concrete Bases	15.000	EACH	.	.
0090	204.0220 Removing Inlets	4.000	EACH	.	.
0100	204.0225 Removing Septic Tanks	1.000	EACH	.	.

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			DOLLARS	CTS	DOLLARS	CTS
0110	204.0235 Removing Buildings (parcel) 001. West Salem SWEF	LUMP	LUMP		.	
0120	204.0240 Site Clearance (parcel) 001. West Salem SWEF	LUMP	LUMP		.	
0130	204.0245 Removing Storm Sewer (size) 018. 18-Inch	127.000 LF	.		.	
0140	204.0245 Removing Storm Sewer (size) 030. 30-Inch	266.000 LF	.		.	
0150	204.0265 Abandoning Wells	1.000 EACH	.		.	
0160	205.0100 Excavation Common	158,408.000 CY	.		.	
0170	205.0200 Excavation Rock	470.000 CY	.		.	
0180	213.0100 Finishing Roadway (project) 001. 1070-00-72	1.000 EACH	.		.	
0190	213.0100 Finishing Roadway (project) 002. 1070-00-73	1.000 EACH	.		.	
0200	214.0100 Obliterating Old Road	17.000 STA	.		.	
0210	305.0110 Base Aggregate Dense 3/4-Inch	2,500.000 TON	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0220	305.0120 Base Aggregate Dense 1 1/4-Inch	27,800.000 TON	.		.	
0230	405.0100 Coloring Concrete WisDOT Red	765.000 CY	.		.	
0240	415.0100 Concrete Pavement 10-Inch	17,600.000 SY	.		.	
0250	415.0110 Concrete Pavement 11-Inch	1,250.000 SY	.		.	
0260	415.0120 Concrete Pavement 12-Inch	15,800.000 SY	.		.	
0270	416.0610 Drilled Tie Bars	1,105.000 EACH	.		.	
0280	416.0620 Drilled Dowel Bars	160.000 EACH	.		.	
0290	416.1710 Concrete Pavement Repair	180.000 SY	.		.	
0300	416.1720 Concrete Pavement Replacement	400.000 SY	.		.	
0310	440.4410 Incentive IRI Ride	3,087.000 DOL	1.00000		3087.00	
0320	455.0605 Tack Coat	310.000 GAL	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0330	460.2000 Incentive Density HMA Pavement	1,610.000 DOL	1.00000		1610.00	
0340	460.5223 HMA Pavement 3 LT 58-28 S	1,250.000 TON	.		.	
0350	460.5224 HMA Pavement 4 LT 58-28 S	1,250.000 TON	.		.	
0360	465.0110 Asphaltic Surface Patching	10.000 TON	.		.	
0370	465.0315 Asphaltic Flumes	100.000 SY	.		.	
0380	465.0400 Asphaltic Shoulder Rumble Strips	6,610.000 LF	.		.	
0390	520.8000 Concrete Collars for Pipe	4.000 EACH	.		.	
0400	522.0124 Culvert Pipe Reinforced Concrete Class III 24-Inch	203.000 LF	.		.	
0410	522.0130 Culvert Pipe Reinforced Concrete Class III 30-Inch	20.000 LF	.		.	
0420	522.0148 Culvert Pipe Reinforced Concrete Class III 48-Inch	169.000 LF	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0430	522.1012 Apron Endwalls for Culvert Pipe Reinforced Concrete 12-Inch	EACH 4.000	.		.	
0440	522.1015 Apron Endwalls for Culvert Pipe Reinforced Concrete 15-Inch	EACH 1.000	.		.	
0450	522.1018 Apron Endwalls for Culvert Pipe Reinforced Concrete 18-Inch	EACH 1.000	.		.	
0460	522.1024 Apron Endwalls for Culvert Pipe Reinforced Concrete 24-Inch	EACH 5.000	.		.	
0470	522.1030 Apron Endwalls for Culvert Pipe Reinforced Concrete 30-Inch	EACH 2.000	.		.	
0480	522.1048 Apron Endwalls for Culvert Pipe Reinforced Concrete 48-Inch	EACH 2.000	.		.	
0490	523.0519 Apron Endwalls for Culvert Pipe Reinforced Concrete Horizontal Elliptical 19x30-Inch	EACH 2.000	.		.	
0500	602.0410 Concrete Sidewalk 5-Inch	SF 5,075.000	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0510	602.0505 Curb Ramp Detectable Warning Field Yellow	64.000 SF	.		.	
0520	606.0200 Riprap Medium	200.000 CY	.		.	
0530	608.0312 Storm Sewer Pipe Reinforced Concrete Class III 12-Inch	703.000 LF	.		.	
0540	608.0315 Storm Sewer Pipe Reinforced Concrete Class III 15-Inch	307.000 LF	.		.	
0550	608.0318 Storm Sewer Pipe Reinforced Concrete Class III 18-Inch	71.000 LF	.		.	
0560	608.0324 Storm Sewer Pipe Reinforced Concrete Class III 24-Inch	24.000 LF	.		.	
0570	610.0419 Storm Sewer Pipe Reinforced Concrete Horizontal Elliptical Class HE-IV 19x30-Inch	137.000 LF	.		.	
0580	611.0612 Inlet Covers Type C	1.000 EACH	.		.	
0590	611.0624 Inlet Covers Type H	5.000 EACH	.		.	
0600	611.0642 Inlet Covers Type MS	10.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0610	611.2004 Manholes 4-FT Diameter	2.000 EACH	.		.	
0620	611.3230 Inlets 2x3-FT	4.000 EACH	.		.	
0630	611.3902 Inlets Median 2 Grate	5.000 EACH	.		.	
0640	614.0010 Barrier System Grading Shaping Finishing	2.000 EACH	.		.	
0650	614.2300 MGS Guardrail 3	600.000 LF	.		.	
0660	614.2610 MGS Guardrail Terminal EAT	4.000 EACH	.		.	
0670	614.2620 MGS Guardrail Terminal Type 2	4.000 EACH	.		.	
0680	616.0100 Fence Woven Wire (height) 001. 4-Ft	4,800.000 LF	.		.	
0690	616.0329 Gates Chain Link (width) 001. 4-Ft	1.000 EACH	.		.	
0700	618.0100 Maintenance And Repair of Haul Roads (project) 001. 1070-00-72	1.000 EACH	.		.	
0710	619.1000 Mobilization	1.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0720	623.0200 Dust Control Surface Treatment	56,400.000 SY	.		.	
0730	624.0100 Water	1,200.000 MGAL	.		.	
0740	625.0100 Topsoil	25,950.000 SY	.		.	
0750	625.0500 Salvaged Topsoil	58,000.000 SY	.		.	
0760	627.0200 Mulching	57,900.000 SY	.		.	
0770	628.1504 Silt Fence	12,250.000 LF	.		.	
0780	628.1520 Silt Fence Maintenance	6,150.000 LF	.		.	
0790	628.1905 Mobilizations Erosion Control	16.000 EACH	.		.	
0800	628.1910 Mobilizations Emergency Erosion Control	8.000 EACH	.		.	
0810	628.2004 Erosion Mat Class I Type B	30,300.000 SY	.		.	
0820	628.6510 Soil Stabilizer Type B	8.000 ACRE	.		.	

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0830	628.7005 Inlet Protection Type A	10.000 EACH	.		.	
0840	628.7010 Inlet Protection Type B	5.000 EACH	.		.	
0850	628.7015 Inlet Protection Type C	5.000 EACH	.		.	
0860	628.7504 Temporary Ditch Checks	300.000 LF	.		.	
0870	628.7515.S Stone or Rock Ditch Checks	35.000 CY	.		.	
0880	628.7555 Culvert Pipe Checks	50.000 EACH	.		.	
0890	628.7560 Tracking Pads	3.000 EACH	.		.	
0900	629.0210 Fertilizer Type B	55.000 CWT	.		.	
0910	630.0120 Seeding Mixture No. 20	2,280.000 LB	.		.	
0920	630.0130 Seeding Mixture No. 30	440.000 LB	.		.	
0930	630.0140 Seeding Mixture No. 40	15.000 LB	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
0940	630.0200 Seeding Temporary	2,940.000 LB	.		.	
0950	631.0300 Sod Water	32.000 MGAL	.		.	
0960	631.1000 Sod Lawn	1,450.000 SY	.		.	
0970	632.0201 Shrubs (species) (size) (root) 001. Wentworth American Cranberry CG 24-Inch Ht	3.000 EACH	.		.	
0980	632.0201 Shrubs (species) (size) (root) 002. Goldmound Spirea CG 18-Inch Ht	14.000 EACH	.		.	
0990	632.0201 Shrubs (species) (size) (root) 003. Crimson Pygmy Barberry CG 18-Inch Ht	35.000 EACH	.		.	
1000	632.0201 Shrubs (species) (size) (root) 004. Goldfinger Potentilla CG 18-Inch Ht	4.000 EACH	.		.	
1010	632.0201 Shrubs (species) (size) (root) 005. Tauton Anglojap Yew CG 18-Inch Ht	7.000 EACH	.		.	
1020	632.0201 Shrubs (species) (size) (root) 006. Broadmoor Juniper CG 18-Inch Ht	3.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1030	632.9101 Landscape Planting Surveillance and Care Cycles	16.000 EACH	.		.	
1040	633.0100 Delineator Posts Steel	149.000 EACH	.		.	
1050	633.0500 Delineator Reflectors	175.000 EACH	.		.	
1060	633.1100 Delineators Temporary	60.000 EACH	.		.	
1070	633.5100 Markers Row	9.000 EACH	.		.	
1080	633.5200 Markers Culvert End	8.000 EACH	.		.	
1090	634.0614 Posts Wood 4x6-Inch X 14-FT	27.000 EACH	.		.	
1100	634.0616 Posts Wood 4x6-Inch X 16-FT	19.000 EACH	.		.	
1110	634.0618 Posts Wood 4x6-Inch X 18-FT	7.000 EACH	.		.	
1120	634.0620 Posts Wood 4x6-Inch X 20-FT	4.000 EACH	.		.	
1130	634.0622 Posts Wood 4x6-Inch X 22-FT	8.000 EACH	.		.	

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1140	635.0200 Sign Supports Structural Steel HS	1,650.000 LB	.		.	
1150	636.0100 Sign Supports Concrete Masonry	4.000 CY	.		.	
1160	636.0500 Sign Supports Steel Reinforcement	204.000 LB	.		.	
1170	637.1220 Signs Type I Reflective SH	396.000 SF	.		.	
1180	637.2210 Signs Type II Reflective H	295.050 SF	.		.	
1190	637.2230 Signs Type II Reflective F	34.000 SF	.		.	
1200	638.2102 Moving Signs Type II	1.000 EACH	.		.	
1210	638.2601 Removing Signs Type I	4.000 EACH	.		.	
1220	638.2602 Removing Signs Type II	11.000 EACH	.		.	
1230	638.3000 Removing Small Sign Supports	12.000 EACH	.		.	

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1240	638.3100 Removing Structural Steel Sign Supports	8.000 EACH	.		.	
1250	638.3610 Erecting State Owned Signs Type I	1.000 EACH	.		.	
1260	642.5001 Field Office Type B	1.000 EACH	.		.	
1270	642.6001 Field Laboratory	1.000 EACH	.		.	
1280	643.0200 Traffic Control Surveillance and Maintenance (project) 001. 1070-00-72	440.000 DAY	.		.	
1290	643.0200 Traffic Control Surveillance and Maintenance (project) 002. 1070-00-73	15.000 DAY	.		.	
1300	643.0300 Traffic Control Drums	5,350.000 DAY	.		.	
1310	643.0420 Traffic Control Barricades Type III	130.000 DAY	.		.	
1320	643.0705 Traffic Control Warning Lights Type A	260.000 DAY	.		.	
1330	643.0715 Traffic Control Warning Lights Type C	1,970.000 DAY	.		.	

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1340	643.0800 Traffic Control Arrow Boards	55.000 DAY	.		.	
1350	643.0900 Traffic Control Signs	7,530.000 DAY	.		.	
1360	643.0920 Traffic Control Covering Signs Type II	3.000 EACH	.		.	
1370	643.1050 Traffic Control Signs PCMS	80.000 DAY	.		.	
1380	645.0130 Geotextile Type R	390.000 SY	.		.	
1390	645.0140 Geotextile Type SAS	630.000 SY	.		.	
1400	646.0106 Pavement Marking Epoxy 4-Inch	31,750.000 LF	.		.	
1410	646.0116 Pavement Marking Epoxy 6-Inch	2,200.000 LF	.		.	
1420	646.0126 Pavement Marking Epoxy 8-Inch	2,050.000 LF	.		.	
1430	646.0600 Removing Pavement Markings	7,000.000 LF	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1440	647.0566 Pavement Marking Stop Line Epoxy 18-Inch	30.000 LF	.		.	
1450	647.0656 Pavement Marking Parking Stall Epoxy	510.000 LF	.		.	
1460	647.0706 Pavement Marking Diagonal Epoxy 6-Inch	25.000 LF	.		.	
1470	647.0726 Pavement Marking Diagonal Epoxy 12-Inch	200.000 LF	.		.	
1480	647.0746 Pavement Marking Diagonal Epoxy 24-Inch	300.000 LF	.		.	
1490	647.0766 Pavement Marking Crosswalk Epoxy 6-Inch	150.000 LF	.		.	
1500	649.0400 Temporary Pavement Marking Removable Tape 4-Inch	18,500.000 LF	.		.	
1510	649.1400 Temporary Pavement Marking Stop Line Removable Tape 24-Inch	30.000 LF	.		.	
1520	649.2100 Temporary Raised Pavement Markers Type I	110.000 EACH	.		.	
1530	650.4000 Construction Staking Storm Sewer	20.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1540	650.4500 Construction Staking Subgrade	11,450.000 LF	.		.	
1550	650.5000 Construction Staking Base	220.000 LF	.		.	
1560	650.5500 Construction Staking Curb Gutter and Curb & Gutter	190.000 LF	.		.	
1570	650.6000 Construction Staking Pipe Culverts	6.000 EACH	.		.	
1580	650.7000 Construction Staking Concrete Pavement	11,200.000 LF	.		.	
1590	650.8500 Construction Staking Electrical Installations (project) 001. 1070-00-72	LUMP	LUMP		.	
1600	650.9910 Construction Staking Supplemental Control (project) 001. 1070-00-72	LUMP	LUMP		.	
1610	650.9920 Construction Staking Slope Stakes	11,450.000 LF	.		.	
1620	652.0225 Conduit Rigid Nonmetallic Schedule 40 2-Inch	7,810.000 LF	.		.	
1630	652.0235 Conduit Rigid Nonmetallic Schedule 40 3-Inch	240.000 LF	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1640	652.0700.S Install Conduit into Existing Item	1.000 EACH	.		.	
1650	653.0905 Removing Pull Boxes	20.000 EACH	.		.	
1660	654.0106 Concrete Bases Type 6	27.000 EACH	.		.	
1670	654.0111 Concrete Bases Type 11	8.000 EACH	.		.	
1680	654.0230 Concrete Control Cabinet Bases Type L30	1.000 EACH	.		.	
1690	655.0610 Electrical Wire Lighting 12 AWG	4,829.000 LF	.		.	
1700	655.0620 Electrical Wire Lighting 8 AWG	2,409.000 LF	.		.	
1710	655.0630 Electrical Wire Lighting 4 AWG	39,906.000 LF	.		.	
1720	656.0200 Electrical Service Meter Breaker Pedestal (location) 001. CB100	LUMP	LUMP		.	
1730	657.0255 Transformer Bases Breakaway 11 1/2-Inch Bolt Circle	27.000 EACH	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
1740	657.0327 Poles Type 6-Aluminum	27.000 EACH	.		.	
1750	657.0715 Luminaire Arms Truss Type 4 1/2-Inch Clamp 15-FT	29.000 EACH	.		.	
1760	659.0400 Luminaires High Mast Lighting	4.000 EACH	.		.	
1770	659.0700 Lighting Units Walkway	8.000 EACH	.		.	
1780	659.1120 Luminaires Utility LED B	29.000 EACH	.		.	
1790	659.2130 Lighting Control Cabinets 120/240 30-Inch	1.000 EACH	.		.	
1800	660.0100 High Mast Foundation (location) 001. HM1	LUMP	LUMP		.	
1810	660.0100 High Mast Foundation (location) 002. HM2	LUMP	LUMP		.	
1820	660.0200 High Mast Lighting Tower (location) 001. HM1	LUMP	LUMP		.	
1830	660.0200 High Mast Lighting Tower (location) 002. HM2	LUMP	LUMP		.	

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			DOLLARS	CTS	DOLLARS	CTS
1840	661.0100 Temporary Traffic Signals for Bridges (structure) 001. STH 16-VWS	LUMP	LUMP			.
1850	671.0112 Conduit HDPE 1-Duct 2-Inch	1,300.000 LF	.		.	
1860	671.0222 Conduit HDPE Directional Bore 2-Duct 2-Inch	300.000 LF	.		.	
1870	671.0300 Fiber Optic Cable Marker	5.000 EACH	.		.	
1880	673.0105 Communication Vault Type 1	1.000 EACH	.		.	
1890	678.0024 Install Fiber Optic Cable Outdoor Plant 24-CT	1,950.000 LF	.		.	
1900	678.0400 Fiber Optic Termination	6.000 EACH	.		.	
1910	678.0500 Communication System Testing	LUMP	LUMP			.
1920	690.0150 Sawing Asphalt	960.000 LF	.		.	
1930	690.0250 Sawing Concrete	4,250.000 LF	.		.	

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WISC 2016247

CONTRACTOR : _____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1940	715.0415 Incentive Strength Concrete Pavement	3,210.000 DOL	1.000000		3210.00	
1950	SPV.0060 Special 001. Remove Street Light	15.000 EACH	.		.	
1960	SPV.0060 Special 002. Pull Box Non-Conductive 24X42-Inch	39.000 EACH	.		.	
1970	SPV.0060 Special 101. Underground LP Tanks and Piping	1.000 EACH	.		.	
1980	SPV.0060 Special 102. Trash Receptacles	2.000 EACH	.		.	
1990	SPV.0090 Special 001. Construction Staking Fence	4,800.000 LF	.		.	
2000	SPV.0090 Special 002. Concrete Curb & Gutter 24-Inch Type A Special	1,700.000 LF	.		.	
2010	SPV.0090 Special 003. Concrete Curb & Gutter 24-Inch Type D Special	190.000 LF	.		.	
2020	SPV.0090 Special 004. Fiber Optic Tracer Cable	1,600.000 LF	.		.	
2030	SPV.0090 Special 005. Fence Chain Link 6-Ft Special	60.000 LF	.		.	

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			DOLLARS	CTS	DOLLARS	CTS
2040	SPV.0105 Special 001. Telephone Service, Sparta SWEF	LUMP	LUMP			.
2050	SPV.0105 Special 002. Electrical Service, Sparta SWEF	LUMP	LUMP			.
2060	SPV.0105 Special 003. Natural Gas Service, Sparta SWEF	LUMP	LUMP			.
2070	SPV.0105 Special 004. Construction Staking Initial Layout Parking Lot	LUMP	LUMP			.
2080	SPV.0105 Special 005. Construction Staking Subgrade Parking Lot	LUMP	LUMP			.
2090	SPV.0105 Special 006. Construction Staking Concrete Pavement Parking Lot	LUMP	LUMP			.
2100	SPV.0105 Special 007. Concrete Pavement Joint Layout	LUMP	LUMP			.
2110	SPV.0105 Special 101. SWEF Building, General Construction	LUMP	LUMP			.
2120	SPV.0105 Special 102. SWEF Building, Plumbing	LUMP	LUMP			.
2130	SPV.0105 Special 103. SWEF Building, Heating and Ventilating	LUMP	LUMP			.

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			DOLLARS	CTS	DOLLARS	CTS
2140	SPV.0105 Special 104. SWEF Building, Electrical	LUMP	LUMP			.
2150	SPV.0105 Special 105. Well Pump and Controls	LUMP	LUMP			.
2160	SPV.0105 Special 106. Emergency Generator	LUMP	LUMP			.
2170	SPV.0105 Special 107. Holding Tanks	LUMP	LUMP			.
2180	SPV.0105 Special 108. Lightning Protection and Grounding System	LUMP	LUMP			.
2190	SPV.0105 Special 200. Weigh-In-Motion System	LUMP	LUMP			.
2200	SPV.0105 Special 201. Static Scale System	LUMP	LUMP			.
2210	SPV.0105 Special 202. Weigh-In-Motion System Warranty Maintenance	LUMP	LUMP			.
2220	SPV.0105 Special 203. Static Scale System Warranty Maintenance	LUMP	LUMP			.
2230	SPV.0105 Special 301. Communications Tower	LUMP	LUMP			.

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			DOLLARS	CTS	DOLLARS	CTS
2240	SPV.0105 Special 401. Removing Weight Scale And Pit	LUMP	LUMP			.
2250	SPV.0105 Special 402. Removing Underground LP Tank	LUMP	LUMP			.
2260	SPV.0180 Special 001. Scale Approach Pavement Reinforcement	270.000 SY		.		.
	SECTION 0001 TOTAL					.
	TOTAL BID					.

PLEASE ATTACH SCHEDULE OF ITEMS HERE