HIGHWAY WORK PROPOSAL

Proposal Number: 1 5

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

COUNTY	STATE PROJECT ID	FEDERAL PROJECT ID	PROJECT DESCRIPTION	HIGHWAY
Douglas	1190-43-71		Superior - Rockmont Road Superior Safety and Weight Facility #72	USH 2/53

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, $ 310,000.00 Payable to: Wisconsin Department of Transportation	Attach Proposal Guaranty on back of this PAGE.
Bid Submittal Due Date: November 11, 2014 Time (Local Time): 9:00 AM	Firm Name, Address, City, State, Zip Code **SAMPLE** **NOT FOR BIDDING PURPOSES**
Contract Completion Time June 30, 2016	
Assigned Disadvantaged Business Enterprise Goal 0 %	This contract is exempt from federal oversight.

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

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

Subscribed and sworn to before me this date _____

(Signature, Notary Public, State of Wisconsin)

(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 Clearing and grubbing, grading, excavation, base aggregate, storm sewer, culvert pipe, HMA pavement, concrete pavement, concrete curb and gutter, signing, pavement marking, site lighting, plantings, landscaping, wetland mitigation, building, weigh-in-motion system and static weigh 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 2007 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://www.dot.wisconsin.gov/business/engrserv/bid-letting-information.htm. 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://www.dot.wisconsin.gov/business/engrserv/bid-letting-information.htm 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.

B Submitting Electronic Bids

B.1 On the Internet

(1) Do the following before submitting the bid:

1. Have a properly executed annual bid bond on file with the department.
2. Have a digital ID on file with and enabled by Info Tech Inc. Using this digital ID will constitute the bidder's signature for proper execution of the bidding proposal.

(2) In lieu of preparing, delivering, and submitting the proposal as specified in 102.6 and 102.9 of the standard specifications, submit the proposal on the internet as follows:

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

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

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

(1) Download the latest schedule of items from the Wisconsin pages of the Bid Express™ web site reflecting the latest addenda posted on the department's web site at **http://www.dot.wisconsin.gov/business/engrserv/bid-letting-information.htm**. Use Expedite ™ software to prepare and print the schedule of items. Provide a valid amount for all price fields. Follow instructions and review the help screens provided on the Bid Express™ web site to assure that the schedule of items is prepared properly.

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

Bidder Name

BN00

Proposals: 1, 12, 14, & 22

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

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

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

1. The check code printed on the bottom of the printout of the Expedite™ generated schedule of items is not the same on each page.
2. The check code printed on the printout of the Expedite™ generated schedule of items is not the same as the check code for that proposal provided on the diskette or CD ROM.

3. The diskette or CD ROM is not submitted at the time and place the department designates.

C Waiver of Electronic Submittal

(1) The bidder may request a waiver of the electronic submittal requirements. Submit a written request for a waiver in lieu of bids submitted on the internet or on a printout with accompanying diskette or CD ROM. Use the waiver that was included with the paper bid document sent to the bidder or type up a waiver on the bidder's letterhead. The department will waive the electronic submittal requirements for a bidding entity (individual, partnership, joint venture, corporation, or limited liability company) for up to 4 individual proposals in a calendar year. The department may allow additional waivers for equipment malfunctions.

(2) Submit a schedule of items on paper conforming to section 102 of the standard specifications. The department charges the bidder a $75 administrative fee per proposal, payable at the time and place the department designates for receiving bids, to cover the costs of data entry. The department will accept a check or money order payable to: "Wisconsin, Dept. of Transportation."

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

1. The bidder fails to provide the written request for waiver of the electronic submittal requirements.
2. The bidder fails to pay the $75 administrative fee before the time the department designates for the opening of bids unless the bidder requests on the waiver that they be billed for the $75.
3. The bidder exceeds 4 waivers of electronic submittal requirements within a calendar year.

(4) In addition to the reasons specified in section 102 of the standard specifications, the department may refuse to issue bidding proposals for future contracts to a bidding entity that owes the department administrative fees for a waiver of electronic submittal requirements.

PROPOSAL BID BOND

Wisconsin Department of Transportation

DT1303 1/2006

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

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

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

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

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

PRINCIPAL

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

(Signature and Title)

(Company Name)

(Signature and Title)

(Company Name)

(Signature and Title)

(Company Name)

(Signature and Title)

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

Wisconsin Department of Transportation

DT1305 8/2003

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

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

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

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

(Signature of Authorized Contractor Representative) (Date)

March 2010

LIST OF SUBCONTRACTORS

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

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

Name of Subcontractor	Class of Work	Estimated Value

DECEMBER 2000

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

Instructions for Certification

1. By signing and submitting this proposal, the prospective contractor is providing the certification set out below.

2. The inability of a person to provide the certification required below will not necessarily result in denial of participation in this covered transaction. The prospective contractor shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective contractor to furnish a certification or an explanation shall disqualify such person from participation in this transaction.

3. The certification in this clause is a material representation of fact upon which reliance was placed when the department determined to enter into this transaction. If it is later determined that the contractor knowingly rendered an erroneous certification in addition to other remedies available to the Federal Government the department may terminate this transaction for cause or default.

4. The prospective contractor shall provide immediate written notice to the department to whom this proposal is submitted if at any time the prospective contractor learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

5. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549. You may contact the department to which this proposal is being submitted for assistance in obtaining a copy of those regulations.

6. The prospective contractor agrees by submitting this proposal that, should this contract be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department entering into this transaction.

7. The prospective contractor further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," which is included as an addendum to PR-1273 - "Required Contract Provisions Federal Aid Construction Contracts," without

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

8. The contractor may rely upon a certification of a prospective subcontractor/materials supplier that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A contractor may decide the method and frequency by which it determines the eligibility of its principals. Each contractor may, but is not required to, check the Disapproval List (telephone # 608/266/1631).

9. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

10. Except for transactions authorized under paragraph 6 of these instructions, if a contractor in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department may terminate this transaction for cause or default.

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

(1) The prospective contractor certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offense enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective contractor is unable to certify to any of the statements in this certification, such prospective contractor shall attach an explanation to this proposal.

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SPECIAL PROVISIONS

1. General.

Perform the work under this construction contract for Project 1190-43-71, Superior-Rockmont Road, Superior Safety and Weight Enforcement Facility #72, USH 2/53, Douglas 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, 2014 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 (20140630)

2. Referenced Construction Specifications.

Building Construction shall conform to the "General Conditions of the Contract for Construction" AIA Document A201 - 1997, 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, 2014 Edition governs.

3. Scope of Work.

The work under this contract shall consist of clearing and grubbing, topsoil removal, grading, culvert pipe, storm sewer, borrow excavation, excavation below subgrade, curb and gutter, concrete pavement, HMA pavement, base aggregate, building demolition, wetland mitigation and creation, concrete pavement removal, weigh-in-motion system, static weigh scale, operations and inspection building, communications tower, site lighting, signing, traffic control 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.

Trans 401 requires an Erosion Control implementation plan (ECIP) be submitted to the project manager and to the Department of Natural Resources at least 14 days prior to the Pre-construction conference. The ECIP must be approved prior to start of work. The ECIP shall supplement information shown on the plan and shall not reproduce it. The ECIP shall identify how the contractor intends to implement the project's erosion control plan. Failure of not having an approved ECIP at time of execution will not be a consideration for a time extension. Also, by not having an approved ECIP at the time of execution, the engineer may start the contract time but not authorize the contract work to begin. The plan shall also contain detailed staging for placing all temporary and permanent landscaping items to provide for the winterization of the project.

Operations shall be scheduled so that the work shall be continuous and orderly along the roadway.

Prior to beginning operations under this contract, the contractor shall, in writing, submit proposed schedule of operations and method of coordination and handling freeway traffic to the engineer.

The contractor's schedule of operations shall indicate working with a large force and adequate equipment to ensure that the work will be completed within the established contract time.

Comply with all local ordinances, which apply to his operations, if working during nighttime work hours. Any ordinance variance issued by the municipality or required permits shall be furnished to the engineer by the contractor, in writing before performing such work.

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

The contractor's work schedule for any permanent lane closure, when permitted by the engineer, shall indicate a continuous effort to complete the work in a timely manner. One lane in each direction of the highway shall be entirely clear to traffic at all times.

Work on USH 2/53 during peak traffic periods shall be restricted to working in closed off lanes or areas. Work may be performed provided such work operations do not include ingress and egress of vehicles and equipment, which would obstruct the flow of traffic on the freeway during peak traffic periods unless allowed by the engineer. Peak traffic periods are from 6:00 AM to 8:30 AM and 3:30 PM to 6:00 PM weekdays.

No equipment, vehicles or construction materials shall be parked or stored within 30 feet of the edge of the traffic lane of any roadway carrying USH 2/53 traffic or within 20 feet of the edge of the traffic lane or ramps during non-working hours except at locations and periods of time approved by the engineer. At such locations, the materials and equipment involved shall not constitute a hazard to the traveling public.

No equipment or vehicles will be permitted to directly cross the live traffic lanes of USH 2/53. All construction vehicles shall yield to all through traffic at all locations.

Do not begin or continue any work that closes traffic lanes or ramps outside of the allowed time periods specified in this article or the article "Traffic". If the contractor fails to open all lanes of traffic and ramps by the specified times, then a reduction of $3,000 per hour per traffic lane or ramp for each hour of lane or ramp 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 or ramp closure violation occurs. The total reduction from monies due to the contractor shall be the summation of the separate reductions for each lane and each ramp closure violation. The department will assess hourly damages for the road not being open to traffic under the administrative item Failing to Open Road to Traffic.

Full Time Lane Closures. A lane is closed to traffic 24 hours per day.

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

There will be four traffic control stages during construction. This includes Stage 1, Stage 2, Stage 3, and Stage 4.

Stage 1 work will include:

- Begin site stripping, clearing and grubbing.
- Borrow excavation
- Begin construction on main weight facility.
- Construct new site roads and parking areas.
- Construct all applicable culvert extension.
- Traffic control for this stage will consist of temporary lane closures.

Items of work under Stage 1 will include earthwork, clearing and grubbing, crushed aggregate base course, concrete paving and asphaltic concrete paving.

Stage 2 work will include:

- Continue all work listed in stage 1.
- Continue construction on main weight facility.
- Construction of ramp connections to the mainline highway for the new facility for the northbound on ramp and southbound off ramp requiring temporary lane closures.
- Maintain weigh-in-motion installation requiring long-term lane closures.
- Traffic control for this stage will involve short-term and long-term lane closures.

Items of work under Stage 2 include earthwork, crushed aggregate base course, concrete paving, asphalt concrete paving and storm sewer.

Stage 3 work will include:

- Completing construction on main weight facility area.
- Construction of ramp connections to the mainline highway for the new facility for the northbound off ramp and southbound on ramp.
- Traffic control for this stage will involve long-term lane closures when working adjacent to USH 2/53.

Items of work under Stage 3 include earthwork, crushed aggregate base course, concrete paving, asphalt concrete paving and storm sewer.

Stage 4 work will include:

- Demolition work on existing site structures.
- Demolition work on existing site.
- Wetland creation work at old site.
- Traffic control for this stage will consist of temporary lane closures.

Items of work under Stage 4 include concrete removal and structure removal earthwork and wetland creation.

Substantially complete the safety and weigh facility building prior to 12:01 AM May 2, 2016. The substantial completion date is 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 building and develop the final punch list. The substantial completion date is also the date of commencement of applicable warranties required by the contract documents.

Supplement standard spec 108.11 as follows:

If the facility is not substantially complete prior to 12:01 AM, May 2, 2016, a deduction of $1810 per calendar day or portion thereof, will be made from money due under this contract for project 1190-43-71 for each calendar day the contract work remains incomplete beyond 12:01 AM, May 2, 2016.

Each day shall be defined as a 24 hour period beginning at 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 before completing all work specified in the contract, additional liquidated damages will be affixed in accordance to standard spec 108.11.

Upon setting of static scale decks and load cells, construction equipment shall not be allowed to drive upon the decks. Block the decks off by means of traffic control drums and tape or by other acceptable methods.

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.

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

Stage 1
No long-term closures will be allowed on USH 2/53 during Stage 1 construction. Site access shall be established through the existing weight enforcement facility in a manner as not to interfere with normal operations of that site. Provide traffic control at these locations as per the traffic control plans.

Stage 2
Short-term single lane closures are permitted during daytime hours during the removal of the existing median side shoulders for the construction of the southbound off and the northbound on ramps to the new facility.

For mainline weigh-in-motion installation, long-term overnight lane closures will be permitted on weekdays from 6:00 AM Monday to 2:00 PM Friday.

Stage 3
Short-term single lane closures are permitted during daytime hours during the removal of the existing median side shoulders for the construction of the southbound on and the northbound off ramps to the new facility. This stage should not be started until the new facility is operational. This is to allow for the shortest possible time between closure of the old facility and the start-up of the new facility.

Stage 4
Short-term single lane closures will be allowed on USH 2/53 during Stage 4 construction. Site access shall be established through the new weight enforcement facility in a manner as not to interfere with normal operations of that site. Provide traffic control at these locations as per the traffic control plans.

Portable Changeable Message Signs shall be used three working days in advance of and during highway lane closures to indicate such closures and to notify drivers of changing traffic patterns.

Traffic control for stage changes shall only be allowed during nighttime working hours.

Advance Notification
Notify the engineer a minimum of 14 days before work is to begin on the freeway.

In addition, the following advance notifications shall be called in:

Lane closures	10 calendar days
Nighttime work	10 calendar days
Construction Stage changes	14 calendar days
Facility Closure	14 calendar days

Weigh-In-Motion Installation.
During the mainline weigh-in-motion installation, drums and traffic control devices shall be placed in the traffic lane such that there is a single 12-foot minimum clear lane width. This reduced lane width shall be allowed only for the time necessary to complete saw cutting and weigh-in-motion component installation. Immediately upon completion of each operation, the drums and traffic control devices shall be placed such that the live traffic lanes are entirely clear.

Facility Closure
The Wisconsin State Patrol SWEF sergeant, Tim Weiberg (715) 635-2141 shall be notified of the intention of closing the existing facility 14 days prior to the actual closure of the facility. Prior to the closure the new facility shall be fully operational and accepted by WisDOT; thus, allowing for the shortest possible time between facilities being closed.

7. Holiday Work Restrictions.

Do not perform work on, nor haul materials of any kind along or across any portion of the highway carrying USH 2/53 traffic, and entirely clear the traveled way and shoulders of such portions of the highway of equipment, barricades, signs, lights and any other material that might impede the free flow of traffic during the following holiday periods:

- From noon Friday, May 22, 2015 to 6:00 AM Tuesday, May 26, 2015 for Memorial Day;
- From noon Friday, July 3, 2015 to 6:00 AM Monday, July 6, 2015 for Independence Day;
- From noon Friday, September 4, 2015 to 6:00 AM Tuesday, September 8, 2015 for Labor Day;
- From noon Friday, November 20, 2015 to 6:00 AM Monday, November 23, 2015 for deer hunting season opening;
- From 6:00 AM Thursday, December 24, 2015 to 6:00 AM Monday, December 28, 2015 for Christmas;
- From noon Friday, May 27, 2016 to 6:00 AM Tuesday, May 31, 2016 for Memorial Day;
- From noon Friday, July 1, 2016 to 6:00 AM Tuesday, July 5, 2016 for Independence Day.

107-005 (20050502)

8. Utilities.

This contract does not come under the provisions of Administrative Rule TRANS 220.

There are underground facilities located within the project limits at the existing facility site. There are known utility adjustments required for both the existing weight facility and the proposed weight facility as noted below. The Contractor shall coordinate construction activities with a call to Diggers Hotline, Utilities Locate Wisconsin (800) 242-8511 or a direct call to the utilities, which have facilities in the area as required per statutes. The Contractor shall use caution to insure the integrity of underground facilities at all times.

When utility adjustments become necessary during construction, the utility owner will make the required adjustments in coordination with the Contractor's construction operation unless otherwise noted below.

Bidders are advised to contact each utility company listed in the plans, prior to preparing their bids, to obtain current information on the status of any utility relocation work stated herein.

Dahlberg Light and Power Company: has a buried service for the existing weight enforcement facility at approximate station 338“E”+50 from the south bound lanes to the existing building. This service will be abandoned when it is no longer needed. Contractor will contact Dahlberg Light and Power, five days prior notice for the electric line removal or taken out of service. They have no other utilities within the project limits.

Dahlberg will be installing and supplying new 3-phase electrical service in coordination with this project. The new service line is proposed to run on the north side of Webb Road, then continuing east along the south section line of Sections 23 and 24 to the USH 2/53 right-of-way.

CenturyLink: has a buried service for the existing weight enforcement facility at approximate station 338“E”+50 from the south bound lanes to the existing building. This service will be abandoned when it is no longer needed. Contractor will contact CenturyLink, five days prior notice for the phone line removal or taken out of service. They have no other utilities within the project limits.

CenturyLink has installed a new buried service line from Cutter Road, along the south USH 2/53 right-of-way, to a point opposite of the new SWEF. Contractor will need to arrange to have a new service installed to the facility.

Network Service, Superior SWEF: The Board of Regents of the University of Wisconsin System and CCI Systems, Inc, a public-private partnership, have an existing network fiber facility located along the south side of the USH 2/53 right-of-way. The fiber optic facility consists of a 96-count SMA/SA fiber optic cable, vaults (handholes), aboveground markers, and other associated appurtenances. The fiber is placed inside a 1-¼-inch inside diameter HDPE conduit. The facility is located a varying distance, 65 feet to 90 feet, from the centerline of the eastbound lanes. No direct conflicts are anticipated.

During this project, state forces will provide an underground service to the SWEF building by installing conduit and fiber optic cable between an existing vault (handhole) and the proposed SWEF building including a directional bore under USH 2/53.

WisDOT electric utilities: The existing safety and weight enforcement facility has additional buried electric lines on the existing site to run electric signs, lights and signals around the facility. Most of the on-site electric facilities will not be conflict with new construction until the existing facility is being demolished with the exception of the line that runs from station 315“E”+00 to station 338“E”+50 along the southbound lanes for USH 2/53. At station 315+00 and station 329+00 there are electronic message signs for the existing facility that shall remain operational until the closure of that facility.

The existing buried electric for the site lighting around the existing facility runs along the south side of the southbound ramps and the north side of the northbound ramps. There are also nine luminaires fed by underground electric within the external roadways and parking lot of the existing facilities. The actual route of the electric line is not known but

should not be in conflict with construction until the new facility is in operation and the existing facility is being demolished.

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 USH 2/53.

Median crossings connecting USH 2/53 eastbound and westbound roadways shall not be utilized by construction vehicles during construction operations.

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

The department has obtained a U.S. Army Corps of Engineers Section 404 permit. Comply with the requirements of the permit in addition to requirements of the special provisions. A copy of the permit is available from the regional office by contacting William J Kovaleski, Jr., PE at (715) 392-7832 or (715) 225-9431 (cell).
107-054 (20080901)

11. Wetland Biologist Monitor.

This project includes construction of a wetland restoration site within the project limits. These sites are from Station 329+00 to Station 348+00 LT. and RT. And Station 282+00 to Station 287+00 LT. and RT., along existing route. Prosecution of work in these areas will require an approved wetland biologist on site prior to the activities listed below being preformed.

1. Clearing and Grubbing for New Facility
2. Grading Shaping and Finishing Wetland Site
3. Salvage Topsoil at New Facility
4. Placing Topsoil at Wetland Restoration
5. Seeding Wetland
6. Mulching Certified Weed-Free

Notify the Northwest Region Environmental Coordinator, Amy Adrihan, (715) 392-7972, two weeks prior to doing any work in these areas. The department will provide a qualified biologist to be on site at all times when work occurs for this activities.

If a potentially significant environmental issue arises during construction operations, the qualified biologist will promptly coordinate with the WisDOT engineer and the Environmental Coordinator to determine an appropriate course of action. In the event of a significant issue, potential project delays may occur.

12. Environmental Protection.

Supplement standard spec 107.18 as follows:

Install silt fence around the project limits before any clearing or grubbing activity begins. Environmentally sensitive resources exist beyond the project limits, including wetlands and species of special concern. Equipment shall not be operated outside of the project limits without approval from the engineer.

When engaged in roadway cleaning operations, 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.

13. Environmental Protection, Aquatic Exotic Species Control.

Exotic invasive organisms such as VHS, zebra mussels, purple loosestrife, and Eurasian water milfoil are becoming more prolific in Wisconsin and pose adverse effects to waters of the state. Wisconsin State Statutes 30.07, "Transportation of Aquatic Plants and Animals; Placement of Objects in Navigable Waters", details the state law that requires the removal of aquatic plants and zebra mussels each time equipment is put into state waters.

At construction sites that involve navigable water or wetlands, use the follow cleaning procedures to minimize the chance of exotic invasive species infestation. Use these procedures for all equipment that comes in contact with waters of the state and/or infested water or potentially infested water in other states.

Ensure that all equipment that has been in contact with waters of the state, or with infested or potentially infested waters, has been decontaminated for aquatic plant materials and zebra mussels prior to being used in other waters of the state. Before using equipment on this project, thoroughly disinfect all equipment that has come into contact with potentially infested waters. Use the following inspection and removal procedures (guidelines from the Wisconsin Department of Natural Resources http://dnr.wi.gov/topic/fishing/documents/vhs/disinfection_protocols.pdf for disinfection:

1. Prior to leaving the contaminated site, wash machinery and ensure that the machinery is free of all soil and other substances that could possibly contain exotic invasive species;

2. Drain all water from boats, trailers, bilges, live wells, coolers, bait buckets, engine compartments, and any other area where water may be trapped;
3. Inspect boat hulls, propellers, trailers and other surfaces. Scrape off any attached mussels, remove any aquatic plant materials (fragments, stems, leaves, seeds, or roots), and dispose of removed mussels and plant materials in a garbage can prior to leaving the area or invested waters; and
4. Disinfect your boat, equipment and gear by either:
    a. Washing with ~212º F water (steam clean), or
    b. Drying thoroughly for five days after cleaning with soap and water and/or high pressure water, or
    c. Disinfecting with either 200 ppm (0.5 oz per gallon or 1 Tablespoon per gallon) Chlorine for 10-minute contact time or 1:100 solution (38 grams per gallon) of Virkon Aquatic for 20- to 30-minute contact time. Note: Virkon is not registered to kill zebra mussel veligers nor invertebrates like spiny water flea. Therefore this disinfect should be used in conjunction with a hot water (>104º F) application.

Complete the inspection and removal procedure before equipment is brought to the project site and before the equipment leaves the project site. The contractor shall notify the engineer in advance of performing decontamination. Work shall not proceed to clear, grub, or salvage topsoil in the area of the new SWEF #72, or for wetland restoration construction until the contractor receives written notice from the engineer that all necessary decontamination has been acceptably completed

14. 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-topsoiling of graded areas as designated by the engineer, shall be done immediately after grading is completed within those areas. Seeding and sodding for each construction Stage shall be completed as shown on erosion control plans or directed by the engineer within ten working days after topsoiling.

Exposed and topsoiled areas not to be graded until spring of 2016 shall be seeded and/or temporarily seeded prior to October 15, 2015. In areas where seeding occurs after October 15, 2015, Soil Stabilizer, Type B and all other erosion control measures shall be applied as determined by the engineer.

15. Building Removals and Demolition.

Perform this work in accordance to standard spec 204, and hereby modified as follows:

The work under this contract consists of razing and removing of buildings together with the disposal of all material and debris, removing miscellaneous land improvements, if any, placing compacted backfill in the exposed basements and openings resulting from the removal of the buildings and grading the vacant site. The abutting highway shall be kept free of debris and mud throughout the performance of the work under this contract. The present sanitary sewer or septic systems and water systems are to be abandoned in accordance to current statutes, ordinances and regulations.

The public streets and highways, if any, that serve as access for the heavy equipment shall be planked with suitable timbers to preclude any damages to said facilities. Any damages to these public facilities shall be repaired or replaced with like materials at the expense of the contractor.

All roads, highways or public places adjacent to any building or buildings being razed or removed shall be maintained in a debris or litter-free condition throughout the life of this contract.

However, should the use of the above highways be required for razing or backfilling operations, splash boards or reflector panels should be erected and warning signs placed at appropriate locations to protect the general public.

Perform the following:

Remove the structures from the premises.

All asbestos and hazardous waste shall be removed and disposed of in compliance with current local, state and federal guidelines and laws, including asbestos not discovered in the pre-razing inspections included in these specifications. The most recent edition of any applicable standard, code, or regulation shall be in effect. Where conflict among the requirements of these specifications occurs, the most stringent shall be followed. Only a qualified and licensed asbestos removal contractor shall perform the removal of asbestos. If the razing contractor is not licensed to remove asbestos, they must employ a licensed subcontractor to perform this work. An inspection report for each building indicating the presence or absence of asbestos in exposed positions of the structure is included in this proposal.

Arrange for the public and/or private utility companies to disconnect their services and remove meters. Arrangements shall be made with the local plumbing inspectors to inspect the abandonment of well and septic systems and/or sewer and water laterals. All water well abandonments shall be accomplished by licensed water well drilling and servicing contractors in accordance to state laws and administrative rules.

All demolition, removal and backfilling operations shall be conducted in such a manner as will interfere as little as possible with vehicular traffic on adjacent streets and highways. Barricades shall be used when needed to guarantee the safety of pedestrians or motorists.

Upon completion of the backfilling operations of the exposed basements and other openings, the area shall be fine graded and shaped.

Custody of the Building
Upon written order by the engineer to commence work, the buildings; and surrounding State-owned property shall be under the custody of the contractor. Nothing in this proposal shall be interpreted as setting forth the condition of any building or the appurtenances thereto. Except as otherwise provided herein, it is to be understood that the department accepts no responsibility for the protection of buildings and appurtenances against damages sustained either prior to or subsequent to the time of the letting of the work under this contract. Take such measures as are necessary to safeguard the public from damages or injury.

While the buildings are in the custody of the contractor, they must remain in a closed condition. No doors or windows to the buildings are to be removed from the buildings until the actual day of razing. All salvaging of the building components is to be done by the contractor or his Subcontractor only. At no time is the general public to be allowed in the buildings.

Traffic
Vehicular traffic shall be maintained on the roads and highway adjacent to these premises through the duration of this contract.

Legal Relations and Responsibility to the Public.
Supplement standard spec 107.3 with the following:

Procure all the permits necessary to carry out the work, including those necessary while the roads and highways are obstructed either by operations or by the storage of equipment or materials.

The awarding of this contract does not guarantee the issuance of a permit to move structures over state highways.

The contractor agrees not to move any of the structures within a proposed highway corridor of the State of Wisconsin.

Supplement standard spec l07.8 with the following:

Notify the local law enforcement agency and Fire Department and any surface transportation company, which may be affected by the anticipated street obstructions or hazards.

Supplement standard spec 107.22 with the following:

Notify the various public or municipal utility companies to disconnect and remove such of their facilities as may be in the buildings, or attached to them, sufficiently in advance of beginning of razing operations to allow the utilities to make their disconnections.

Removal and Razing Operations.
Perform this work in accordance to standard spec 204 and as supplemented with the following:

Furnish all labor, equipment, tools, transportation and incidentals necessary for the performance of the work.

The basement walls, floors and footings shall be broken, rolled and removed in their entirety from the site.

Any concrete steps, concrete sidewalks and concrete slabs shall be removed from the premises.

All material shall be removed from the premises in a safe manner and in compliance with all applicable laws and ordinances. Adjacent property shall not be disturbed.

The sewer and water lines and/or wells and septic systems shall be sealed or abandoned in a manner in compliance with the ordinances and permit requirements of the municipality in which the buildings are situated in the presence of the local Governing Unit. All water wells shall be sealed and abandoned by a licensed well drilling and servicing contractor, which party shall be responsible for the preparation and distribution of the required well abandonment report to Department of Natural Resources. A copy of this report shall be given the Wisconsin Department of Transportation, NW-Superior office, Attn: Brendan Dirkes, 1701 N. 4th Street, Superior, WI 54880-1068, NW-Superior Region Contact Person.

Standing walls shall be reasonably and safely braced at all times to ensure complete safety during the wrecking operations, until those items have been razed.

Disposal of Materials
Supplement standard spec 104.8 with the following:

All salvage removed from the buildings, including fixtures and appurtenances such as screens, and storm sash shall be the property of the contractor and shall be entirely removed from the premises. The entire premises shall be cleared of all decomposable and combustible refuse, debris and materials resulting from the removal of the buildings and upon completion of the work, shall be left in a neat condition. No decomposable or combustible refuse, debris, or materials resulting from the removal of the buildings shall

be deposited or left on any state-owned lands, or rights of way of any highways, including any exposed openings resulting from razing activities.

All non-hazardous demolition waste shall be disposed of in a landfill licensed or approved in writing by the Department of Natural Resources and in accordance to NR 500, Wisconsin Administrative Code. Failure to properly dispose of solid waste is a violation of State Solid Waste Statutes and Administrative code and is subject to issuance of a citation under Wisconsin Statute 159.81(3).

Any hazardous materials may only be removed from the site, after proper notification and compliance with the requirements of the Wisconsin Department of Natural Resources and local government regulations.

All living trees, shrubs, evergreens and other vegetation shall remain the department's property. Use care to preserve as much of the landscaping as reasonably possible.

Asbestos Removal

A copy of the Asbestos inspection report may be obtained from Robert Spoerl, WisDOT Roadside Facilities, at (608) 266-8665. Comply with the requirements of the Environmental Protection Agency (EPA) regulations, National Emission standards for Asbestos, the Occupational Safety and Health Administration (OSHA) regulations on asbestos removal, and all applicable Wisconsin Department of Natural Resources (DNR), and local government regulations. The most recent edition of any applicable standard, code or regulation shall be in effect. Where conflict among the requirements of these specifications occurs, the most stringent shall be followed. In addition, the following must be met:

1. Any person performing asbestos abatement must comply with all training and certification requirements, rules, regulations and laws of the State of Wisconsin regarding asbestos removal.

2. Proper notification must be given to the Department of Natural Resources and the Department of Health and Social Services at least ten working days prior to starting the project.

3. Provide copies of all transport manifests, trip tickets and disposal receipts for all asbestos waste materials removed from the work area during the abatement process to the Wisconsin Department of Transportation, Northwest Region, Superior Office, Attn: Brendan Dirkes, 1701 N. 4th Street, Superior, WI 54880-1068, NW-Superior Region Contact Person.

Asbestos removal is considered incidental to razing and removing buildings and will not be measured for payment separately.

Fencing
After removal of the buildings, furnish and erect suitable fencing around the basement and porch openings to protect and safeguard the public from any and all hazardous conditions created by his operations. The fencing shall be installed in such a manner to ensure that the general public is prevented from falling into the basement. The fence shall be a height of 52 inches and the posts shall be at least 58 inches spaced at a distance no greater than 10 feet apart. After the open basement and porch excavations have been satisfactorily backfilled, the fencing shall be removed.

Backfill
Prior to any backfill operations, notify the department to inspect any exposed areas resulting from the razing and removal operations. The exposed basements and openings shall be free of any and all refuse and debris.

The exposed basements and openings shall be backfilled in accordance to standard spec 203.2.4, to the present surrounding ground elevation. Compaction of the backfill shall be in accordance to standard spec 207.3.6.2. Backfilling materials shall be Granular Backfill in accordance to standard spec 209.

The septic systems shall be filled with granular material and the wells and/or sanitary sewers, if any, shall be abandoned in compliance with all ordinances and permit requirements of the municipality in which the buildings are situated and those of the State of Wisconsin.

Notice to Department of Natural Resources.
Notify the Department of Natural Resources (DNR) Northern Region – Amy Cronk, (715) 635-4229, at least ten working days in advance of the intent to raze or otherwise remove the parcel. This notice to DNR shall include the address and type of building(s) to be razed or removed, the proposed date that each will be razed or removed, and the name of the licensed or approved landfill where the demolition waste will be disposed. A copy of this notification shall be mailed to the Wisconsin Department of Transportation, Attn: Brendan Dirkes, 1701 N. 4th Street, Superior, WI 54880-1068, NW-Superior Office.

Well abandonment reports required by law will also be prepared and submitted to the DNR by the well abandonment subcontractor in the manner prescribed herein.

16. Concrete Pavement.

Supplement standard spec 715.2 with the following:

Concrete mix designs shall be the responsibility of the contractor. Provide the concrete mix designs necessary to accommodate contractor's operations and contractor scheduling according to the traffic provisions and the prosecution and progress provisions included in the plan. At least 7 business days before producing concrete, submit concrete mix documentation to the engineer for approval. Approval of the design mix does not relieve

the contractor of the responsibility for meeting contractual requirements located within the traffic provisions and the prosecution and progress provisions.

If the geological composition of the coarse aggregate is primarily igneous or metamorphic materials, modify and supplement standard spec 415, standard spec 710, and standard spec 715 with the following:

1. The contractor may use class C fly ash or grade 100 or 120 slag as a partial replacement for Portland cement. For binary mixes use up to 15% fly ash or slag, except for slip-formed work the contractor may use up to 20% slag. For ternary mixes use up to 25% fly ash and slag in combination. Replacement values are in percent by weight of the total cementitious material in the mix.

2. One hundred percent of the aggregate shall pass the 1-inch sieve.

Use of recycled concrete for coarse aggregate will not be allowed.

Supplement standard spec 415.3.16.1(2) with the following:

At anytime during pavement placement or after pavement placement, the engineer may require coring to supplement the probing testing operation for conforming thickness verification to compliment normal QV testing. The coring will be completed at department expense.

17. Concrete Ancillary Cure and Seal Treatment.

All newly constructed concrete curb, curb and gutter, sidewalk and median sloped nose to have surface cure and seal treatment applied.

Materials to conform to a clear treating material listed on the current approved WISDOT product list for "Cure and Seal Compounds for Non-Trafficked Surfaces on Structural Masonry".

Application rates for the treating material shall be in accordance to the manufacturer's specifications.

Cost to be incidental to curb, curb and gutter, sidewalk and median sloped nose bid items.

18. Fence Safety, Item 616.0700.S.

A Description
This special provision describes furnishing and installing a plastic fence at locations shown on the plans and as hereinafter provided.

B Materials
Furnish notched conventional metal "T" or "U" shaped fence posts.

Furnish fence fabric meeting the following requirements.

Color:	International orange (UV stabilized)
Roll Height:	4 feet
Mesh Opening:	1 inch min to 3 inch max
Resin/Construction:	High density polyethylene mesh
Service Temperature:	-60° F to 200° (ASTM D648)
Tensile Yield:	Avg. 2000 lb per 4 ft. width (ASTM D638)
Ultimate Tensile Strength:	Avg. 3000 lb per 4 ft. width (ASTM D638)
Elongation at Break (%):	Greater than 100% (ASTM D638)
Chemical Resistance:	Inert to most chemicals and acids

C Construction
Drive posts into the ground 12 to 18 inches. Space posts at 7 feet.

Use a minimum of three wire ties to secure the fence at each post. Weave tension wire through the top row of strands to provide a top stringer that prevents sagging.

Overlap two rolls at a post and secure with wire ties.

D Measurement
The department will measure Fence Safety by the linear foot along the base of the fence, center-to-center of posts, 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
616.0700.S	Fence Safety	LF

Payment is full compensation for furnishing and installing fence and posts; maintaining the fence and posts in satisfactory condition; and for removing and disposing of fence and posts at project completion.
616-030 (20070510)

19. Landscaping.

Part 1 - General
1.1 Related Documents
Drawings and general provisions of the contract, including general and supplementary conditions and division 1 specification sections, apply to this section.

1.2 Summary
This section includes the following:

1. Trees
2. Shrubs
3. Perennials
4. Topsoil and soil amendments
6. Mineral and organic mulches

1.3 Quality Assurance
Landscape work shall be done by a single firm specializing in landscape work.

Source Quality Control:
Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to engineer, together with proposal for use of equivalent material.

Trees, Shrubs and Plants: Provide freshly dug trees and shrubs. Do not prune prior to delivery unless otherwise approved by architect. 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 architect.

Spray anti-desiccant on deciduous trees and shrubs just prior to transport.

Provide protective covering during delivery.

Deliver trees, shrubs, and plants after preparations for planting have been completed. Plant immediately after delivery. 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.

Do not remove container-grown stock from containers until planting time.

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.

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

Existing Conditions: Contractor shall be required to have visited the site, be familiar with the existing conditions and to have made due allowance for them in a proposal.

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.

Detrimental Conditions: When conditions detrimental to plant, seed, or sod growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify architect before attempting to plant.

1.5 Sequencing and Scheduling

Plant or install materials during normal planting seasons for each type of material required or as approved by architect.

Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.

Plant shrubs after final grades are established and prior to seeding or sodding unless otherwise acceptable to the architect. 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

Perform this work in accordance to standard specs 632 and as hereinafter provided.

Materials

Plant Materials

All plants shall be grown within the State of Wisconsin or Minnesota located within zone 3 or 4 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 in accordance 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.

Fertilizer for Plant Holes

Amend the first paragraph of standard spec 632.2.4.2 to require the amount of fertilizer in each packet be a minimum of 2 ounces with a slow-time release period of 3 years.

Part 3 - Execution
3.1 Construction Methods
Plant Bed Preparation
Planting Layout
Amend standard spec 632.3.3 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.

Excavation of Planting Holes
Revise standard spec 632.3.4 as follows

The minimum horizontal measurement of the plant hole shall not be less than 24 inches 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.

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.

Pruning
Supplement standard spec 632.45 with the following:

All pruning shall be done in accordance to American National Standards Institute publication ANSI A300-1995, "Tree, Shrub and Other Woody Plant Maintenance – Standard Practices". Pruning shall be done in accordance 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.

Planting
Plant in accordance to standard specs 632.3.7 through 632.3.21.

Amend standard spec 632.3.7 as follows:

Note: Potting soil shall be backfilled to a depth of 12 inches within the entire planting bed area over the static scale access tunnel.

3.2 Plant Establishment and Replacement
Plant Establishment Period
A two-year plant establishment period is required in accordance to standard spec 632.3.18.1.2.

3.3 Payment
The payment for landscaping materials shall be as specified in standard spec 632.5.

20. Landscape Planting Surveillance and Care Cycles, 14-Day Intervals, Item 632.9101.01.

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 $500.00 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)

21. Removing Static Scale, Item 204.9060.S.01.

A General
This special provision describes removing the existing static scale and scale pit in accordance to the pertinent provisions of standard spec 204 and as hereinafter provided.

B (Vacant)

C (Vacant)

D Measurement
The department will measure Removing Static Scale as a single complete lump sum unit of work, acceptably completed.

E Payment
Supplement standard spec 204.5 to include the following:

ITEM NUMBER	DESCRIPTION	UNIT
204.9060.S.01	Removing Static Scale	LS

204-025 (20041005)

22. Select Borrow.

Conform to the requirements of standard spec 208 and as hereinafter provided.

Material
Furnish and use material that consists of granular material meeting the following requirements: Grade 1 or Grade 2 of Standard Spec 209.
208-005 (20031103)

23. Base Aggregate Dense 3/4-Inch.

Conform to the requirements of standard spec 305.2.2.1 except for the following:

Material passing the No. 200 Sieve shall not exceed 10.0 percent by weight.

24. 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, 305, and 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://roadwaystandards.dot.wi.gov/standards/cmm/index.htm

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 sublot with any property outside the specification limits is nonconforming. The department may reject material or otherwise determine the final disposition of nonconforming material as specified in standard spec 106.5.

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://www.dot.state.wi.us/business/engrserv/lab-qualification.htm

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 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 2 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 2 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 (20100709)

25. QMP HMA Pavement Nuclear Density.

A Description

Replace standard spec 460.3.3.2 (1) and 460.3.3.2 (4) with the following:

(1) This special provision describes density testing of in-place HMA pavement with the use of nuclear density gauges. Conform to standard spec 460 as modified in this special provision.

(2) Provide and maintain a quality control program defined as all activities and documentation of the following:
1. Selection of test sites.
2. Testing.
3. Necessary adjustments in the process.
4. Process control inspection.

(3) Chapter 8 of the department's construction and materials manual (CMM) provides additional detailed guidance for QMP work and describes required procedures. Obtain the CMM from the department's web site at:

http://roadwaystandards.dot.wi.gov/standards/cmm/index.htm

(4) The department's Materials Reporting System (MRS) software allows contractors to submit data to the department electronically, estimate pay adjustments, and print selected reports. Qualified personnel may obtain MRS software from the department's web site at:

http://www.atwoodsystems.com/mrs

B Materials

B.1 Personnel

(1) Perform HMA pavement density (QC, QV) testing using a HTCP certified nuclear technician I, or a nuclear assistant certified technician (ACT-NUC) working under a certified technician.

(2) If an ACT is performing sampling or testing, 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.2 Testing

(1) Conform to ASTM D2950 and CMM 8.15 for density testing and gauge monitoring methods. Perform nuclear gauge measurements using gamma radiation in the backscatter position. Perform each test for 4 minutes of nuclear gauge count time.

B.3 Equipment

B.3.1 General

(1) Furnish nuclear gauges from the department's approved product list at:
http://www.dot.wisconsin.gov/business/engrserv/approvedprod.htm.

(2) Have the gauge calibrated by the manufacturer or an approved calibration service within 12 months of its use on the project. Retain a copy of the manufacturer's calibration certificate with the gauge.

(3) Prior to each construction season, and following any calibration of the gauge, the contractor must perform calibration verification for each gauge using the reference blocks located in the department's central office materials laboratory. To obtain information or schedule a time to perform calibration verification, contact the department's Radiation Safety Officer at:

Materials Management Section
3502 Kinsman Blvd.
Madison, Wisconsin 53704
Telephone: (608) 243-5998

B.3.2 Correlation of Nuclear Gauges

B.3.2.1 Correlation of QC and QV Nuclear Gauges

(1) Select a representative section of the compacted pavement prior to or on the first day of paving for the correlation process. The section does not have to be the same mix design.

(2) Correlate the 2 or more gauges used for density measurement (QC, QV). The QC and QV gauge operators will perform the correlation on 5 test sites jointly located. Record each density measurement of each test site for the QC, QV and back up gauges.

(3) Calculate the average of the difference in density of the 5 test sites between the QC and QV gauges. Locate an additional 5 test sites if the average difference exceeds 1.0 lb/ft3. Measure and record the density on the 5 additional test sites for each gauge.

(4) Calculate the average of the difference in density of the 10 test sites between the QC and QV gauges. Replace one or both gauges if the average difference of the 10 tests exceeds 1.0 lb/ft3 and repeat correlation process from B.3.2.1 (2).

(5) Furnish one of the QC gauges passing the allowable correlation tolerances to perform density testing on the project.

B.3.2.2 Correlation Monitoring

(1) After performing the gauge correlation specified in B.3.2.1, establish a project reference site approved by the department. Clearly mark a flat surface of concrete or asphalt or other material that will not be disturbed during the duration of the project. Perform correlation monitoring of the QC, QV, and all back-up gauges at the project reference site.

(2) Conduct an initial 10 density tests with each gauge on the project reference site and calculate the average value for each gauge to establish the gauge's reference value. Use the gauge's reference value as a control to monitor the calibration of the gauge for the duration of the project.

(3) Check each gauge on the project reference site a minimum of one test per day if paving on the project. Calculate the difference between the gauge's daily test result and its reference value. Investigate if a daily test result is not within 1.5 lb/ft3 of its reference value. Conduct 5 additional tests at the reference site once the cause of deviation is corrected. Calculate and record the average of the 5 additional tests. Remove the gauge from the project if the 5-test average is not within 1.5 lb/ft3 of its reference value established in B.3.2.2(2).

(4) Maintain the reference site test data for each gauge at an agreed location.

B.4 Quality Control Testing and Documentation

B.4.1 Lot and Sublot Requirements

B.4.1.1 Mainline Traffic Lanes, Shoulders, and Appurtenances

(1) A lot consists of the tonnage placed each day for each layer and target density specified in standard spec 460.3.3.1. A lot may include partial sublots.

(2) Divide the roadway into sublots. A sublot is 1500 lane feet for each layer and target density.

(3) A sublot may include HMA placed on more than one day of paving. Test sublots at the pre-determined random locations regardless of when the HMA is placed. No additional testing is required for partial sublots at the beginning or end of a day's paving.

(4) If a resulting partial quantity at the end of the project is less than 750 lane feet, include that partial quantity with the last full sublot of the lane. If a resulting partial quantity at the end of the project is 750 lane feet or more, create a separate sublot for that partial quantity.

(5) Randomly select test locations for each sublot as specified in CMM 8.15 prior to paving and provide a copy to the engineer. Locate and mark QC density test sites when performing the tests. Perform density tests prior to opening the roadway to traffic.

(6) Use Table 1 to determine the number of tests required at each station, depending on the width of the lane being tested. When more than one test is required at a station, offset the tests 10 feet longitudinally from one another to form a diagonal testing row across the lane.

Lane Width	No. of Tests	Transverse Location
5 ft or less	1	Random
Greater than 5 ft to 9 ft	2	Random within 2 equal widths
Greater than 9 ft	3	Random within 3 equal widths

Table 1

B.4.1.2 Side Roads, Crossovers, Turn Lanes, Ramps, and Roundabouts

(1) A lot represents a combination of the total daily tonnage for each layer and target density.

(2) Each side road, crossover, turn lane, ramp, and roundabout must contain at least one sublot for each layer.

(3) If a side road, crossover, turn lane, or ramp is 1500 feet or longer, determine sublots and random test locations as specified in B.4.1.1.

(4) If a side road, crossover, turn lane, or ramp is less than 1500 feet long, determine sublots using a maximum of 750 tons per sublot and perform the number of random tests as specified in Table 2.

Side Roads, Turn Lanes, Crossovers, Ramps, Roundabouts: Sublot/Layer tonnage	Minimum Number of Tests Required
25 to 100 tons	1
101 to 250 tons	3
251 to 500 tons	5
501 to 750 tons	7

Table 2

B.4.2 Pavement Density Determination

B.4.2.1 Mainline Traffic Lanes and Appurtenances

(1) Calculate the average sublot densities using the individual test results in each sublot.

(2) If all sublot averages are no more than one percent below the target density, calculate the daily lot density by averaging the results of each random QC test taken on that day's material.

(3) If any sublot average is more than one percent below the target density, do not include the individual test results from that sublot when computing the lot average density and remove that sublot's tonnage from the daily quantity for incentive. The tonnage from any such sublot is subject to disincentive pay according to standard spec 460.5.2.2.

B.4.2.2 Mainline Shoulders

B.4.2.2.1 Width Greater Than 5 Feet

(1) Determine the pavement density as specified in B.4.2.1.

B.4.2.2.2 Width of 5 Feet or Less

(1) If all sublot test results are no more than 3.0 percent below the minimum target density, calculate the daily lot density by averaging all individual test results for the day.

(2) If a sublot test result is more than 3.0 percent below the target density, the engineer may require the unacceptable material to be removed and replaced with acceptable material or allow the nonconforming material to remain in place with a 50 percent pay reduction. Determine the limits of the unacceptable material according to B.4.3.

B.4.2.3 Side Roads, Crossovers, Turn Lanes, Ramps, and Roundabouts

(1) Determine the pavement density as specified in B.4.2.1.

B.4.2.4 Documentation

(1) Document QC density test data as specified in CMM 8.15. Provide the engineer with the data for each lot within 24 hours of completing the QC testing for the lot.

B.4.3 Corrective Action

(1) Notify the engineer immediately when an individual test is more than 3.0 percent below the specified minimum in standard spec 460.3.3.1. Investigate and determine the cause of the unacceptable test result.

(2) The engineer may require unacceptable material specified in B.4.3(1) to be removed and replaced with acceptable material or allow the nonconforming material to remain in place with a 50 percent pay reduction. Determine limits of the unacceptable area by measuring density of the layer at 50-foot increments both ahead and behind the point of unacceptable density and at the same offset as the original test site. Continue testing at 50-foot increments until a point of acceptable density is found as specified in standard spec 460.5.2.2(1). Removal and replacement of material may be required if extended testing is in a previously accepted sublot. Testing in a previously accepted sublot will not be used to recalculate a new lot density.

(3) Compute unacceptable pavement area using the product of the longitudinal limits of the unacceptable density and the full sublot width within the traffic lanes or shoulders.

(4) Retesting and acceptance of replaced pavement will be according to standard spec 105.3.

(5) Tests indicating density more than 3.0 percent below the specified minimum, and further tests taken to determine the limits of unacceptable area, are excluded from the computations of the sublot and lot densities.

(6) If 2 consecutive sublot averages within the same paving pass and same target density are more than one percent below the specified target density, notify the engineer and take necessary corrective action. Document the locations of such sublots and the corrective action that was taken.

B.5 Department Testing

B.5.1 Verification Testing

(1) The department will have a HTCP certified technician, or ACT working under a certified technician, perform verification testing. The department will test randomly at locations independent of the contractor's QC work. The department will perform verification testing at a minimum frequency of 10 percent of the sublots and a minimum of one sublot per mix design. The sublots selected will be within the active work zone. The contractor will supply the necessary traffic control for the department's testing activities.

(2) The QV tester will test each selected sublot using the same testing requirements and frequencies as the QC tester.

(3) If the verification sublot average is not more than one percent below the specified minimum target density, use the QC tests for acceptance.

(4) If the verification sublot average is more than one percent below the specified target density, compare the QC and QV sublot averages. If the QV sublot average is within 1.0 lb/ft3 of the QC sublot average, use the QC tests for acceptance.

(5) If the first QV/QC sublot average comparison shows a difference of more than 1.0 lb/ft3 each tester will perform an additional set of tests within that sublot. Combine the additional tests with the original set of tests to compute a new sublot average for each tester. If the new QV and QC sublot averages compare to within 1.0 lb/ft3, use the original QC tests for acceptance.

(6) If the QV and QC sublot averages differ by more than 1.0 lb/ft3 after a second set of tests, resolve the difference with dispute resolution specified in B.6. The engineer will notify the contractor immediately when density deficiencies or testing precision exceeding the allowable differences are observed.

B.5.2 Independent Assurance Testing

(1) Independent assurance is unbiased testing the department performs to evaluate the department's verification and the contractor's QC sampling and testing including personnel qualifications, procedures, and equipment. The department will perform the independent assurance review according to the department's independent assurance program.

B.6 Dispute Resolution

(1) The testers may perform investigation in the work zone by analyzing the testing, calculation, and documentation procedures. The testers may perform gauge correlation according to B.3.2.1.

(2) The testers may use correlation monitoring according to B.3.2.2 to determine if one of the gauges is out of tolerance. If a gauge is found to be out of tolerance with its reference value, remove the gauge from the project and use the other gauge's test results for acceptance.

(3) If the testing discrepancy cannot be identified, the contractor may elect to accept the QV sublot density test results or retesting of the sublot in dispute within 48 hours of paving. Traffic control costs will be split between the department and the contractor.

(4) If investigation finds that both gauges are in error, the contractor and engineer will reach a decision on resolution through mutual agreement.

B.7 Acceptance

(1) The department will not accept QMP HMA Pavement Nuclear Density if a non-correlated gauge is used for contractor QC tests.

C (Vacant)

D (Vacant)

E Payment

E.1 QMP Testing

(1) Costs for all sampling, testing, and documentation required under this special provision are incidental to the 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.

E.2 Disincentive for HMA Pavement Density

(1) The department will administer density disincentives according to standard spec 460.5.2.2.

E.3 Incentive for HMA Pavement Density

(1) Delete standard spec 460.5.2.3.

(2) If the lot density is greater than the minimum specified in standard spec table 460-3 and all individual air voids test results for that mixture are within +1.0 percent or -0.5 percent of the design target in standard spec table 460-2, the department will adjust pay for that lot as follows:

Percent Lot Density Above Minimum	Pay Adjustment Per Ton
From -0.4 to 1.0 inclusive	$0
From 1.1 to 1.8 inclusive	$0.40
More than 1.8	$0.80

(3) The department will adjust pay under the Incentive Density HMA Pavement bid item. Adjustment under this item is not limited, either up or down, to the bid amount shown on the schedule of items.

(4) If a traffic lane meets the requirements for disincentive, the department will not pay incentive on the integrally paved shoulder.

(5) Submit density results to the department electronically using the MRS software. The department will validate all contractor data before determining pay adjustments.

460-020 (20100709)

26. Shrubs Sweetfern, 1-Gallon; Dwarf Pink Pavement Rose, 2-Gallon; Gro-Low Fragrant Sumac, 18-Inch Spread.

A Description

This work shall consist of furnishing and planting perennials as shown on the plans in accordance to standard spec 632 and as provided by these special provisions.

B Materials

Materials shall conform to the requirements of standard spec 632 and as provided by these special provisions.

1. Supplement the weed barrier fabric by adding a 2-inch thick layer of clean, granite chips on top of the fabric. Chips shall be ½-inch maximum size, open graded, washed and grey/black in color.
2. In areas where several plants located in clumps or groups, contractor may install a continuous sheet of weed barrier fabric and granite chips instead of individual circles at each plant. Layout and shape of the areas covered shall be approved by the engineer.

C Construction

Planting methods shall conform to the requirements of standard spec 632 and as supplemented hereinafter.

1. Excavate the plant hole to at least a minimum depth of twelve inches, or as directed by the engineer. The minimum diameter of the plant hole shall be at least two times the diameter of the plant ball or pot.
2. The Landscape Plant Surveillance and Care interval shall be 14 days.

D Measurement

The department will measure Shrubs (Type) as each unit, complete in place and accepted.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
632.0201.01	Bushes: Sweetfern, 1-gallon	Each
632.0201.02	Bushes: Dwarf Pink Pavement Rose, 2-gallon	Each
632.0201.03	Bushes: Gro-Low Fragrant Sumac, 18-inch Spread	Each

Payment is full compensation for providing, transporting, handling, storing, pruning, placing and replacing plant materials; for excavating all plant holes, salvaging topsoil, mixing and backfilling; for providing and applying all fertilizer, weed barrier, stone chips, water, wrapping, guys and braces, rodent protection, herbicides and anti-desiccant spray; and for disposing of all excess and waste materials.

27. Traffic Control.

Perform work in accordance to standard spec 643, and as shown on the plans or as approved by the engineer, except as hereinafter modified.

Provide the Douglas County Sheriff's Department, the Wisconsin State Patrol and the engineer a current telephone number with which the contractor or his representative can be contacted during non-working hours in the event a safety hazard develops.

Supplement standard spec 107.8 as follows:

All construction vehicles and equipment operating on or near roadways open or closed to traffic, shall be equipped with at least one flashing amber light. The flashing amber light shall be activated when vehicles or equipment are operated on the roadway, parked in close proximity to the roadway, and when entering or exiting live lanes of traffic. The flashing amber light shall be mounted approximately midway between the transverse extremities of the vehicles or machinery and at the highest practicable point that provides visibility from all directions. The light shall be of the flashing strobe or revolving type meeting the following minimum requirements.

Flashing Strobe Type Light	**Revolving Type Light**
360-degree lens	360-degree lens
60 to 90 flashes per minute	45 to 90 flashes per minute
5-inch minimum height	4-5/8 inch minimum height
3-3/4 inch minimum diameter	3-3/4 inch minimum diameter

The light shall be equipped with bulbs of 50-candlepower minimum. Mounting shall be either magnetic or permanent. No compensation for furnishing and installing the flashing amber light to contractor owned construction equipment or vehicles will be provided for in the contract.

Do not use flag persons to direct, control, or stop USH 2/53 traffic.

Do not disturb, remove or obliterate any traffic control signs, advisory signs, shoulder delineators or beam guard in place along the traveled roadways that are not shown for removal on the plans without the approval of the engineer.

If any highway lane or ramp is required to be closed due to circumstances caused by the contractor's fault, the department will assess the road user cost incurred to the traveling public and recover such cost from the contractor. A reduction of $3,000 per lane or ramp per hour will be made from monies due to the contractor. Hourly damages will be assessed using administrative item Failing to Open Road to Traffic.

The traffic requirements are subject to change at the direction of the engineer in the event of an emergency.

28. Clearing and Grubbing for New Facility, Item SPV.0005.01.

A Description
This special provision describes methods for clearing and grubbing according to standard spec 201 for the new SWEF #72, in preparation for salvaging marsh excavation within that area.

B (Vacant)

C Construction
Amend standard spec 201.3(2) with the following:

Within the grubbing limits, remove debris with stems >2 inches in diameter, leaving root systems in place for material with stems <2 inches in diameter.

D Measurement
The department will measure Clearing and Grubbing for New Facility by the acre, 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.0005.01	Clearing and Grubbing for New Facility	Acre

Payment is full compensation for the activities as outlined in standard spec 201.5.

29. Final Shaping and Finishing Restoration Site, Item SPV.0005.02.

A Description
This special provision describes the final shaping, and finishing necessary to satisfactorily restore and complete the lakeshore and wetland restoration sites, as directed

by the Wetland Biologist Monitor and described in the wetland mitigation plan, in accordance to the pertinent requirements of the standard specifications, and as hereinafter provided.

B (Vacant)

C Construction
Construct restoration site to the lines and grades as shown on the plans and as modified by the Wetland Biologist Monitor. Furnish the appropriate equipment to shape and finish the restoration site as directed by the Wetland Biologist Monitor. Properly dispose of all surplus and unsuitable material according to standard spec 205.3.12.

D Measurement
The department will measure Final Shaping and Finishing Restoration Site per acre, 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.0005.02	Final Shaping and Finishing Restoration Site	Acre

Payment is full compensation for furnishing all final shaping and finishing necessary to restore and complete the restoration site to the final contours, as directed by the Wetland Biologist Monitor.

Placement of topsoil, seed, and mulch in the wetland restoration sites will be paid for under the appropriate bid items.

30. Telephone Service, Superior SWEF, Item SPV.0055.01.

A Description
This work shall consist of all coordination by contractor and work by utility 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 shall make all arrangements and coordinate telephone utility work with CenturyTel.

Utility to provide telephone service to the SWEF building.

The allowance for telephone utility company charges as specified under special provision "Utilities" shall be incorporated into the lump sum bid price for this bid item. Final price may be adjusted, if necessary, by Contract Change Order if the utility company charge is more than or less than the stated allowance.

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

D Measurement
The department will measure Telephone Service, Superior SWEF by the dollar, acceptably completed.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0055.01	Telephone Service, Superior SWEF	DOL

Payment is full compensation for charges for utility providing underground telephone service to new SWEF Building, furnishing and installing all telephone cable, pedestals and network interface devices, 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.

31. Electrical Service, Superior SWEF, Item SPV.0055.02.

A Description
This work shall consist of all coordination by contractor and work by utility as required to provide electrical service from existing source to the meter at the new SWEF Building, in accordance to the plans and as hereinafter provided. Electrical service shall include underground or overhead single phase and 3-phase power to the site and to transformers near the proposed building and single phase power to mainline WIM location, including furnishing and installation of transformers and transformer pads; underground single phase and 3-phase service to the new SWEF building and mainline WIM location; wire and terminations at transformers and at meter sockets; and meters.

Site lighting; site telephone work, and telephone wiring and equipment within the SWEF Building; electrical work and equipment within the SWEF Building including the meter socket, conduit, and SWEF Building electrical system terminations at the main switch; 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 shall make all arrangements and coordinate electric utility service work with Dahlberg Light and Power Company.

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

The allowance for electric utility company charges as specified under special provision "Utilities" shall be incorporated into the lump sum bid price for this bid item. Final price may be adjusted, if necessary, by Contract Change Order if the utility company charge is more than or less than the stated allowance.

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

D Measurement
The department will measure Electrical Service, Superior SWEF by the dollar, acceptably completed.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.03	Electrical Service, Superior SWEF	DOL

Payment is full compensation for utility providing underground or overhead single phase and 3-phase electric service from existing source to transformer near new SWEF building, underground or overhead single phase service to transformer near mainline WIM location, transformers, transformer pads, meters and all 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.

32. Trash Receptacles, Item SPV.0060.03.

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.0060.03	Trash Receptacles	Each

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

33. Lamp Disposal, High Intensity, Item SPV.0060.04.

A Description

This special provision describes turning in high intensity discharge (mercury vapor, metal halide, and high-pressure sodium) lamps removed under this contract to the department at the 1701 N. 4th Street; Superior, WI, location.

B (Vacant)

C Construction

Lamps which are turned in to the department will be considered the property of the department for proper future disposal, and the contractor will have no further obligation for their disposal. The department will reject improperly packaged lamps.

Deliveries to the department shall be prearranged. Deliveries shall be consolidated into a truckload or more, except that where all the lamps removed under a contract measure less than a truckload, all shall be delivered as one load at one time.

Pack intact lamps in the packaging of the new lamps used to replace, or packaging affording the equivalent protection. Deliver in full, stackable cartons with the name of the contractor written on each carton.

Lamps shall be segregated by type and wattage. Each carton shall be labeled by the type and wattage contained (do not mix) and the quantity.

Pack broken lamps into thick plastic bags, which in turn shall be placed inside sturdy cardboard boxes or the equivalent. The outer packaging shall be marked "broken lamps". Metal containers will be rejected.

Deliver all broken lamps, as noted above, but the department will not pay for broken lamps above a level of ten percent of the total number in the contract. Broken lamps above the ten percent level shall be delivered to the department for no compensation.

If palletized, cartons shall be piled no more than two high and shall be secured to prevent shifting or falling loads.

The department will reject any lamps not removed as part of a contract pay item or otherwise required under this contract.

D Measurement
The department will measure Lamp Disposal, High Intensity by each individual unit delivered to the department properly packaged, 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.0060.04	Lamp Disposal, High Intensity	Each

Payment is full compensation for handling, packaging, labeling and delivering lamps.

This payment will be in addition to payment for the work under which the lamps are removed from service.

34. Removing Light Poles, Item SPV.0060.05.

A Description
This special provision describes removing lighting pole(s), breakaway base, arm(s), and luminaires, as shown in the plans, splicing through the circuit if required at the given site, and storing or removing materials as indicated below.

B (Vacant)

C Construction
Dispose of steel poles off the site. Dispose of luminaires off the site. All materials removed under this item become property of the contractor.

D Measurement
The department will measure Removing Light Poles by each individual unit, acceptably completed. Only lighting units removed and stored in the condition first encountered will be measured for payment.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.05	Removing Light Poles	Each

Payment is full compensation for removing and storing the pole, arm and luminaire; and if required, for splicing through the circuit for operation.

35. Removing LP Tank, Item SPV.0060.06.

A Description
This special provision describes removing all remaining fuel in the tank, disconnecting service line to building, removal and disposal of the existing tank and all appurtenances and backfilling resulting hole with approved material. Also notify the Bureau of Petroleum Inspection and Fire Protection, P.O. Box 7969, Madison, WI 53707, as specified in the Wisconsin Administrative code, Chapter ILHR 10 flammable and combustible liquids.

B (Vacant)

C Construction
Remove all remaining liquid and other materials from existing tank in a manner approved by the Wisconsin Administrative code. Once drainage and venting of the existing tank has been established and accepted by the supervising professional, the system shall be disconnected from the existing building. Upon successful disconnection, the tank and all appenditures of the system can be removed and disposed of in an approved manner. The resulting hole shall be backfilled with select borrow material as to restore to existing adjacent elevations as directed by the supervising professional.

D Measurement
The department will measure Removing LP Tank 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.0060.06	Removing LP Tank	Each

Payment is full compensation for draining, notification, removal, disposal and backfilling as specified above.

36. Underground LP Tanks and Piping, Item SPV.0060.07.

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.0060.07	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.

37. Lighting Control Cabinet, Type WLP, Item SPV.0060.08.

A Description
This special provision describes furnishing and installing lighting control cabinets, Type "WLP" as shown on the plans and as follows.

B Materials
The cabinet type shall be as detailed in the plans and shall be powder coat painted silver or black. The equipment in the cabinet shall be as detailed in the drawings.

C (Vacant)

D Measurement
The department will measure Lighting Control Cabinet, Type WLP 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.0060.08	Lighting Control Cabinet, Type WLP	Each

Payment is full compensation for furnishing and installing all materials, including lighting control cabinets, control equipment, hardware and fittings.

38. Perennials: Black-Eyed Susan, 1-Gallon, Item SPV.0060.09; Prairie Blazingstar, 4-Inch Pot, Item SPV.0060.10.

A Description
This special provision describes furnishing and planting perennials as shown on the plans, in accordance to standard spec 632 and as provided by these specifications.

B Materials
Materials shall conform to the requirements of standard spec 632 and these specifications.

C Construction
Planting methods shall conform to the requirements of standard spec 632 and as supplemented hereinafter.

Supplement standard spec 632.3.7 as follows:

Perennials shall be placed in planting bed backfilled with planting backfill mixture. Holes shall be backfilled with excavated planting backfill mixture.

D Measurement
The department will measure Perennial (Type) 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.0060.09	Perennials: Black-Eyed Susan, 1-Gallon	Each
SPV.0060.10	Perennials: Prairie Blazingstar, 4-Inch Pot	Each

Payment is full compensation for providing plants, storing, handling, planting, care, disposal of excess and waste materials.

39. Grasses: Little Bluestem, 4-Inch Pot, Item SPV.0060.11; Prairie Dropseed, 4-Inch Pot, Item SPV.0060.12.

A Description
This special provision describes furnishing and planting grasses as shown on the plans, in accordance to standard spec 632 and as provided by these specifications.

B Materials
Provide materials in accordance to standard spec 632 and these specifications.

C Construction
Planting methods shall conform to the requirements of standard spec 632 and as supplemented hereinafter.

Supplement standard spec 632.3.7 as follows:

Place grasses in planting bed backfilled with planting backfill mixture. Backfill holes with excavated planting backfill mixture.

D Measurement
The department will measure Grasses (Type) 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.0060.11	Grasses: Little Bluestem, 4-Inch Pot	Each
SPV.0060.12	Grasses: Prairie Dropseed, 4-Inch Pot	Each

Payment is full compensation for providing plants, storing, handling, planting, care, and for disposal of excess and waste materials.

40. Seeding Wetland, Item SPV.0085.01.

A Description
This special provision describes supplying native seed; supplying seed samples, germination test data and storage and delivery of seed, mixing, and raking the seed mix in the wetland seeding zone as shown on the plans or as directed by the engineer; all in accordance to the special provisions provided herein.

B Material
Use the following native seed specifications during seed acquisition.

1. Provide native seed true to species, packed separately, with label information including scientific and common name, quantity, date and location picked, name and company supervising the picking.

2. Provide seed free of non-seed debris and of non-native and/or invasive species including, but not limited to, reed canary grass, purple loosestrife, spotted knapweed and Canada thistle.

3. Provide seed that was picked at the appropriate time for ripeness and viability. Obtain germination test results and certification for a random sample of each species prior to receiving delivery of the seed. Provide written documentation of germination tests to the engineer prior to seeding.

4. Accept seed only if it has a minimum germination rate of 80 percent. If the seed does not meet the minimum required 80 percent germination rate, additional seed must be supplied at the cost of the seed supplier/contractor to meet the total viable seed quantity.

   Native seed not meeting the required 80 percent germination rate will be measured by the equivalent pounds, based on the following formula for each species.

   Equivalent pounds =
   (number of actual pounds of native seed supplied) X (actual percent germination rate/80)

5. Deliver a representative sample of each species to the engineer for inspection and identification prior to the acceptance of the seed.

6. Provide nurse crop in the wetland seeding zone consisting of annual oats (*Avena sativa*) for a spring planting or winter wheat (*Triticum aestivum*) for a fall dormant planting).

B.1 Seed

B.1.1 General

Use the following seeding schedule in each of the designated zones. Prior to seeding, the engineer must approve substitutions or changes to the seeding schedule. Seeding rates and species mixes shall be as follows, or as directed by the engineer:

All common and scientific species names are referenced from National List of Plant Species that Occur in Wetlands: Wisconsin (U.S. Fish and Wildlife Service May 1988).

B.2.1 Wetland Seeding Zones (Site 1: 10.56 Acres, Site 2: 2.44 Acres)

Sow native seed at a rate of 5.65 pounds per acre. Sow nurse crop at a rate of 12.5 pounds per acre. Mix and sow seed on the same day. Sow nurse crop and native seed together. Mix seed with moist sand or sawdust on site prior to seeding. Provide water on site to moisten the sand or sawdust using a ratio of one part moist sand or moist sawdust to one part native seed mix by volume.

B.2.2 Sedges and Rushes

Seed at 0.35 pounds per acre for a total of 4.55 pounds. Provide a minimum of 4 species, with no individual species comprising more than 25% of the total sedge and rush seed mix.

Scientific Name	**Common Name**
Carex scoparia	pointed broom sedge
Carex stricta	tussock sedge
Carex stipata	common fox sedge
Scirpus atrovirens	dark green bulrush
Scirpus cyperinus	woolgrass

B.2.3 Grasses

Seed at 4 pounds per acre for a total of 52 pounds. Provide all species listed, with *Calamagrostis Canadensis* comprising 40% of the grass seed mix, and none of the other species comprising more than 15% of the total grass seed mix.

Scientific Name	Common Name
Calamagrostis canadensis	blue joint grass
Bromus ciliates	fringed brome
Elymus virginicus	Virginia wild rye
Glyceria grandis	tall manna grass
Poa palustris	fowl bluegrass

B.2.4 Forbs

Seed at 0.8 pounds per acre for a total of 10.4 pounds. Provide a minimum of 6 species, with no individual species comprising more than 20% of the total forb seed mix.

Scientific Name	Common Name
Anemone canadensis	Canada anemone
Eupatorium perfoliatum	common boneset
Eupatoriadelphus maculatus	spotted joe-pye weed
Asclepias incarnate	marsh milkweed
Doellingeria umbellate	flat-topped aster
Euthamia graminifolia	grass-leaved goldenrod
Mimulus ringens	blue monkey flower
Symphotrichum lanceolatum	eastern panicled aster

C Construction

Mix the seed at the project site according to the seeding schedules specified under the bid item or as directed by the engineer. Sow seed after September 1, 2015 and prior to November 1, 2015 for a fall dormant seeding or after June 1 for a spring seeding. Do not seed in flooded areas or when conditions are otherwise unsatisfactory for seeding. Provide the engineer two weeks' notice prior to any seeding activities.

Mix and sow seed on the same day. Sow nurse crop and native seed together. Sow seed using Method A, as specified in standard spec 630.3.3.1 or as approved by the engineer.

D Measurement

The department will measure Seeding Wetland by the pound, 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.0085.01	Seeding Wetland	LB

Payment is full compensation for supplying, handling seed; storing seed on-site; weighing, mixing, and sowing seed; supplying water, sand, and/or sawdust for mixing seed.

Seeding Nurse Crop will be paid for under a separate bid item.

41. Concrete Curb Type Special, Item SPV.0090.01.

A Description
This special provision describes constructing concrete curb type special in accordance to standard spec 601, as shown in the plans and as hereinafter provided

B (Vacant)

C (Vacant)

D Measurement
The department will measure Concrete Curb Type Special by the linear foot measured along the base of the curb face, 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.0090.01	Concrete Curb Type Special	LF

Payment is full compensation for preparation of foundation; for furnishing all materials, including concrete masonry expansion joints and reinforcement tie bars; for placing, finishing, protecting, and curing; for sawing of joints; and for backfilling and disposal of surplus materials.

42. Concrete Curb and Gutter 36-Inch Type A Special, Item SPV.0090.02.

A Description
This special provision describes constructing concrete curb and gutter, 36-inch, Type A special in accordance to standard spec 601, as shown in the plans and as hereinafter provided

B (Vacant)

C (Vacant)

D Measurement
The department will measure Concrete Curb and Gutter 36-inch Type A Special by length in linear feet along the base of the curb face, 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.0090.02	Concrete Curb and Gutter 36-inch Type A Special	LF

Payment is full compensation for preparation of foundation; furnishing all materials, including concrete masonry expansion joints and reinforcement tie bars; for placing, finishing, protecting, and curing; for sawing of joints; and for backfilling and disposal of surplus materials.

43. Removing Existing Signal Equipment, Item SPV.0105.01.

A Description
This special provision describes removing and salvaging existing signal equipment at the location indicated on the plans and hereinafter described.

B (Vacant)

C Construction
When removing concrete foundations, the foundations shall be removed to a level at least 3 feet below the adjacent grade, backfilled with approved material, and the surface reconstructed to match the adjoining area. The foundation shall be disposed of outside the right-of-way.

Safely store and arrange for pick-up of all equipment. All equipment shall remain the property of the department. Provide an inventory list of all items removed as part of the signal system to remain the property of the department, including model and serial numbers where applicable. Provide a copy of the contract plan or special provisions showing the quantities and type of equipment removed. The contractor shall be responsible for the condition of the signal equipment from the time of removal until the acceptance of a receipt drawn by the department indicating that the items have been returned in good condition.

D Measurement
The department will measure Removing Existing Signal Equipment 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.0105.01	Removing Existing Signal Equipment	LS

Payment is full compensation for removing concrete bases and signal poles, and for stockpiling and dismantling of signals.

44. Lightning Protection and Grounding System, Item SPV.0105.02.

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 shown on the plans and as approved by 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 at locations shown on the plans with ground whips to equipment noted on plans and 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.0105.02	Lightning Protection and Grounding System	LS

Payment is full compensation for furnishing and installing system, and for testing system.

45. Well Pump and Controls, Item SPV.0105.03.

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.0105.03	Well Pump and Controls	LS

Payment is full compensation for furnishing, installing, transportation, and incidentals necessary to complete the work as specified herein.

46. Weigh-In-Motion System, Item SPV.0105.04.

A General

A.1 Introduction

Furnish and install a weigh-in-motion (WIM) Sorting System to be utilized at the Superior SWEF to pre-weigh, classify and sort vehicles; process information and provide direction to vehicles in motion as they travel 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 electronic OPEN/CLOSED signs, Arrow ↖/CLOSED signs, weigh station Changeable Message Signs (CMS) and Variable Message Signs (VMS). The system will cover both directions of travel.

A vehicle that has been directed to enter the weigh station will be screened again 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 weighing or further inspection. The sort decisions will be based on compliance of speed, side-to-side balance, height limit, axle weights, axle group weights, and gross vehicle weights with the pre-set tolerances.

The mainline and ramp WIM Systems 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
- Lane control signals for ramp systems
- WIM computer system and printer
    - Station Console or virtual graphic display
    - Scale Manager
    - Vehicle display
    - Station PC
    - Override Console

- Overheight detectors
- Weigh Station Variable Message Signs (VMS)
- Weigh Station Changeable Message Signs (CMS)
- LED OPEN/CLOSED and Arrow ↖/CLOSED CMS sign inserts
- On-site communication system
- AVI (automatic vehicle verification) with Pre-Pass Interface
- Portable static wheel load scales

The scope of work is to supply and install the following:

- WIM scales (4 sets)
- Axle sensing, loops, and cabinets.
- Lane control signals including support structures (2).
- Overheight detection installation (2).
- Overview image camera installation.
- Tracking loops to activate lane directional signals and monitor traffic flow downstream of lane directional signals.
- WIM computer system and printer
- New communications conduit and wiring for all new equipment.
- Cable, power wiring and conduit.
- Weigh station Changeable Message Signs (CMS) including supports. (4)
- Weigh station Variable Message Sign (VMS) including support structure.
- LED OPEN/CLOSED and Arrow ↖/CLOSED sign inserts (2 each)
- On-site Communication System
- Portable static wheel load scales

The objective of the department is to have fully operational mainline and ramp sorting systems 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 furnish documentation which demonstrates to the satisfaction of the department that all equipment proposed for use in the Mainline and Ramp WIM Sorting System 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.

As a minimum, the equipment documentations provided by the contractor shall include the following for the mainline and ramp and WIM Systems:

1. Detailed description of how the system requirements will be met.
2. Drawings showing the Station Console and Override Console or virtual graphic display with descriptions.
3. Manufacturer's name and model number, supported by descriptive material for (but not limited to) the standard package components with all accessories identified under "Description." Submittals shall be supported by descriptive material, such as catalog cuts, diagrams, and other data published by the manufacturer, to show conformance to specifications and plan requirements.

A.2 Mainline and Ramp WIM Operational Overview

The mainline and ramp WIM sorting systems shall consist of the following subsystems:

1. Mainline WIM systems
2. Mainline Sorting systems
3. Mainline Compliance systems
4. Enforcement Camera systems
5. AVI (automatic vehicle verification)
6. Ramp WIM systems
7. Ramp Lane Control systems
8. Station computer system
9. Data collection system
10. Backup detection

The weigh-in-motion system shall be located on the northbound and southbound USH 2/53 mainline and exit ramps into the Superior weigh station. This location shall provide coverage of northbound and southbound commercial vehicle traffic on USH 2/53 and shall relay that information to the central weigh station computer.

All vehicles approaching the ramp WIM System shall produce a vehicle record containing an overview image, various weights, and speed, as well as classification information. The WIM System shall determine whether each vehicle is weight compliant based on its allowable weights as set by the weigh station operator.

The WIM 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.

Images of commercial vehicles will be collected and stored by the System Electronics and relayed to the weigh station for all commercial 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 transferred to the central weigh station computer located in the operations building. After the central computer has received the data, any computer with secure network access will be able to connect to the central computer and view the password protected captured images and vehicle records of the suspected violating vehicles.

A.2.1 Mainline WIM Systems

Commercial vehicles approaching the weigh station shall be directed into the left hand lanes by means of static signing. A vehicle approaching the weigh station will pass over the mainline weigh-in-motion (WIM) system, which will be embedded in the highway approximately 3000 feet prior to the weigh station exit ramps. The left lanes will be equipped with WIM Scales that meet ASTM E 1318-09 Type III accuracy and reliability. 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, if a vehicle is overheight and other relevant data to create a vehicle record. An overview image of the passing vehicle will be combined with the vehicle record. Based on a comparison of the vehicle record to the parameters set by the station operator, 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 manual console 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 right lane in order to detect commercial vehicles bypassing the scales in the left lane.

A.2.2 Mainline Sorting Systems

Changeable Message Signs (CMS) shall be used to communicate with the driver after a mainline vehicle analysis has been completed. The Mainline Sorting System shall consist of two changeable message signs and three inductive loops, which are installed along the side of the roadway approximately 1200 feet from the advance WIM system. The Mainline Sorting system shall be controlled by the roadside WIM electronics, which receives the sort decision from the Station Computer. The Mainline Sorting 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 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 OK TO BYPASS
WEIGH STATION

A.2.3 Mainline Compliance Systems

A compliance system shall be located on both lanes of the mainline downstream of the ramp exits. The system may consist of piezoelectric or Kistler quartz vehicle classification configurations to track the commercial vehicles that bypass the weigh station. A WIM scale shall also be located on each exit ramp in order complete the vehicle tracking system.

A.2.4 Enforcement Camera System

The enforcement camera system will consist of an overview image camera mounted alongside the roadway on the Mainline. This camera 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.

A.2.5 Ramp WIM Systems

The accuracy of the WIM system shall conform with ASTM E 1318-09 Type III "Standard Specifications for Highway Weigh-in-Motion (WIM) Systems with user Requirements and Test Methods" performance requirements for a Type III system. Calibration and accuracy tests shall be performed as specified below. Ensure the roadway meets the requirements of Section 6 of ASTM E 1318-09.

The WIM system shall be provided with a roadside cabinet to house the WIM electronics and/or the WIM computer and its peripherals. The WIM computer and its peripherals may optionally be installed inside the scale building.

As commercial vehicles enter the weigh station exit ramp at medium speeds (40 to 55 mph), the sorter system will continuously and automatically collect truck information including speed, gross vehicle weights, axle weights, axle spacing, axle groups, and axle imbalances. From this data, the WIM System will determine whether the vehicle is compliant. Violating PrePass 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 Vehicle Display Windows on the WIM 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 Station Console 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. Each direction of travel will be able to operate in automatic or manual mode (all static or bypass) independently. For example operators can set the northbound WIM to sort vehicles automatically, while at the same time setting the southbound WIM to manually sort all vehicles to the bypass lane.

The system will have the ability to track the suspect violators using in-road inductive loops while on route to the static scales.

There shall be a ramp back-up detection system with a volume-controlled audio alarm.

The Station Console will provide manual control to the Weigh Station for the operation of the Changeable Message Signs and OPEN/CLOSED Signs.

The system shall be able to collect continuous data on the vehicles entering the station for statistical analysis. The data collection system to 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 telephone modem communications or network connection.

A.2.6 WIM Scale Auto-Calibration

To eliminate costly ramp calibrations the ramp WIM scales shall electronically interface with the static scale. On a continuous basis the static scale shall ensure WIM accuracy and calibration.

Calibration of the WIM system 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.

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 E 1318-09. 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 weight station afterwards.

The accuracy requirements described in ASTM E 1318-09 will remain in effect. Vehicles that traverse the scale with live loads, or liquid loads (unstable static weight) shall not be considered. The accuracy requirements described in ASTM E 1318-09 shall remain in effect. Vehicles shall be first weighed by the WIM System, then by the Static Scale System.

A.2.7 Ramp Lane Control System (LCS)

Each ramp lane control system shall consist of an overhead LED CMS system that is linked to the WIM system. For the bypass lane, the 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 to have a dual-sided display, also visible to the scale house. The signs to be mounted and supported on a pole/mast arm structure.

Furnish, install and make operational new LED OPEN/CLOSED and ↖/CLOSED CMS inserts into sign panels

A.2.8 Station Computer System and Operator Interface

Using the 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 alarm 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 USH 2/53. An audible alarm 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.

A.2.9 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.

A.2.9.1 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 or network connection. 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.

A.2.9.2 Information Available

The following information shall be made available from the data collection feature of the Mainline and Ramp WIM systems:

1. Reports over any selected time period in hourly increments, daily, weekly, or monthly.
2. Summary of vehicle speeds.
3. Summary of vehicle classification counts.
4. Vehicle counter.
5. Reports on the number of violating and non-violating axles, axle groups and gross vehicle weights.
6. User selected reports based on adjustable parameters such as periods and vehicle types.
7. Customization for generating reports for specific needs that are not available using basic parameters or the ability to export data to an Microsoft Excel compatible format.

A.2.10 Backup Detection

Backup Detection is used to prevent a situation where too many vehicles are queued up to a weight station. This can potentially lead to collisions if vehicles are unable to decelerate in time. Traffic on the ramp should be monitored automatically and continuously. When detection of a possible vehicle backup occurs, the system will automatically override the OPEN/CLOSED sign and direct all vehicles away from the station in either direction. When the backup situation has cleared, the system will automatically resume normal control of the OPEN/CLOSED sign so vehicles can again be directed toward the station. A static scale lane backup can also cause the station ramps to backup. The number of

vehicles in the static scale lane should also be automatically and continuously monitored. When a static scale backup is detected, the ramp LCS systems should sort all trucks to the bypass lane until the backup clears

A.3 WIM System Functional Requirements

A.3.1 WIM Scales

The accuracy of the WIM system will be in conformance with Type III ASTM E 1318-09 "Standard Specifications for Highway Weigh-in-Motion (WIM) Systems with User Requirements and Test Method" performance requirements for a Type III system.

Grind the concrete roadway beginning 200 feet prior to the 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 E 1318-09.

The WIM scales shall be constructed of two independent weighing platforms placed across a roadway. The WIM scales will utilize load cells. Each scale module shall be a self-contained weighing unit. The WIM scales shall measure approximately 144-inches x 38-inches including frame. Each scale module shall measure approximately 72-inches x 38-inches including frame.

The WIM scales shall operate properly in a temperature range of -40°F to +160°F.

The WIM scale shall be installed flush with the road surface. The WIM scales shall be weather-sealed. Water, ice, snow, salt, debris, dirt, moisture, or sand will not degrade scale performance.

The WIM scales and frames shall be grounded with ground rods. The signal processing electronic components/modules shall be protected against lightning.

The WIM scales and their frames shall be hot-dip galvanized per ASTM A123 for protection. All installation hardware shall be either stainless steel or galvanized. All surface mounting bolt and service holes shall be sealed.

The load cell cables for the WIM scales shall be shielded cable to prevent damage by rodents.

A.3.2 Axle Sensors

The 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.

A.3.3 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.

Detector loops shall be installed in or below new concrete pavement. Loops shall not be cut directly into the roadway and loop sawcuts will not be exposed to the roadway surface.

Detector loops shall placed in order to control signals and for the system to operate as described in the special provisions. 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.

A.3.4 Conduit and Pull Boxes

All cables shall be in conduit unless specifically approved by the engineer. All conduit installed shall meet the requirements of standard spec 652. All pull boxes shall meet the requirements of standard spec 653.

All materials shall comply with the National Electrical Code and the current standard specifications, Standard Detail Drawings, and special requirements by department weigh-in-motion specifications. Use duct seal to seal all conduits in the cabinets and in all pull boxes. All conduits shall have a polyethylene pull string with at least 210-pound break strength left in place at completion of construction.

Use separate conduits 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”.

A.3.5 WIM Electronics

The Weigh-In-Motion (WIM) Interface Electronics shall be located next to the weigh-in-motion scales in an existing roadside cabinet. The electronics will be all new and existing electronics shall not be reused. 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. Lane directional signals
6. Overview cameras
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.

All cutouts and openings in the electronics housing cabinet shall be vermin proofed.

All electrical work shall meet the requirements of standard spec 651.

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.

A.4 WIM System Operation

A.4.1 Operational Overview

The Weigh Station system shall be located in the scale house and will collect data from the WIM electronics and static scale, for central monitoring and control of the facility operation. The system will have operator displays and consoles to control signals and signs, monitor vehicle movements, adjust WIM sorting parameters, view and control the static scale, and run reports.

The Weigh Station System will be made up of the following components:

- A Central Weigh Station PC
- A Station Console
- An Override Console
- Vehicle Display Windows (displays will vary by manufacturer)
- Static Scale Manager.

A.4.2 Weigh Station System Functional Requirements

The Weigh Station System shall provide the following functions:

1. Perform single-lane WIM operation on both ramps.
2. Perform weight compliance analysis on vehicles in accordance to Wisconsin DOT regulations.
3. Monitor safety conditions of the facility these include:
   a) A WIM scale back up in either direction
   b) Ramp back up in either direction
   c) Static scale lane back up
4. Perform sorter operation in accordance to decisions based on weight compliance analysis, other violations (speeding, improper maneuvers, etc.), station console selection, override console selection, safety conditions and operator selected action.
5. Insert sequence numbers for vehicle records for tracking purposes.
6. Display of vehicle record in windows.
7. Track vehicle movement in the execution of sorter operation.
8. Control display of the LCS to synchronize with the movement of a vehicle being tracked.
9. Provide vehicle records for those that have been sorted to or come to the static scale.
10. Automatically position each vehicle on the static scale using the static scale variable message sign.
11. Provide real time display and control of the static scale.
12. Allow operators to automatically sequence vehicles across the static scale or manually weigh by accumulating axles.
13. Automatically determine and provide operators feedback based on whether a vehicle is potentially overweight based on axle spacings, axle, axle group, gross, and front/rear bridge weights based on Wisconsin regulations.
14. Automatically release vehicles that are properly positioned on the scale, not overweight based on Wisconsin regulations and do not have other violations.
15. Allow operators to print weight tickets.
16. Provide audible message alarms to alert operators of conditions that may require their attention.
17. Provide reports on system operation.
18. Perform data collection, data storage, file management and report generation functions for collected vehicle information.
19. Allow adjustment of WIM and system settings.

The WIM system shall have application programs to detect prolonged power failure conditions to initiate orderly shutdown operation.

A.4.3 Station Console

The Station Console shall 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 Mainline Sorter and Ramp LCS manually. The Station Console shall have visual indicators to identify the mode of control of each Sorter and LCS. Mainline Sorter and Ramp LCS control shall be on a single screen. It shall provide the following functions:

1. Select automatic sort control of each Mainline Sorter and Ramp LCS system or the manual control of the LCS by the operator.
2. In manual control of the Mainline Sorter by an operator, each Sorter can be set for all vehicles to enter the station or to all bypass.
3. In manual control of the LCS by an operator, each LCS can be set for all vehicles to come to the static scale or to all bypass.
4. Status of the directional signals, status of the overhead signals, open/closed signs, and static scale message sign.
5. The Station system must provide an audible warning for the following conditions:
   a) WIM scale backup including direction
   b) Violator in the bypass lane including direction
   c) Station automatically closing with direction because ramp is backed up
   d) Station is automatically reopening with direction ramp has cleared.

A.4.4 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 sign in either direction. The console will also include the ability to control the static scale and bypass lane message signs.

The override signal control console will be located adjacent to the Station Console. It will provide the ability for the operator to manually override the directional signals. It will be a minimum of 24 inches long and 10 inches wide with large push buttons and switches to allow officers to quickly locate and change signal controls when override is require.

The Override Console must be operationally independent of the weigh-in-motion interface electronics, the Station Console, and the Station Computer to control all directional lights, i.e., the override console shall remain operational even if the Station computer is not functioning.

A.4.5 Vehicle Display Windows

On the Station Computer will be Windows to display vehicle records from the WIM system. There shall be two separate display monitors, one for each travel direction. The record for each vehicle will have:

- Sequence number
- Time and date
- Class
- Speed
- Gross vehicle weight
- Lane
- Direction of travel
- Violations highlighted in red
- Individual axle weights with violations highlighted in red
- Individual, front bridge, rear bridge, and full vehicle spacing
- Tandem/tridem 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

A vehicle record shall be displayable in either graphic form or in text form. An alternate to the first format, graphical, is a tabular presentation OR, as designed by the manufacturer and approved by the state.

The length from axle to axle shall be shown on a linear scale with axle spacings plotted below the scale line. An asterisk or red text shown at the axle spacing shall indicate the location of an overweight axle or axle group.

When a vehicle passes over the WIM scale, its corresponding vehicle information consisting of vehicle configuration (i.e. number of axles and their groupings) and axle spacings are displayed.

The vehicle records Display must show the following violation information in addition to weight violations:

1. Missed Scale - A vehicle has missed the scales, i.e., loops triggered but no axle counts.
2. Off-scale - One or more of the off-scale detectors was triggered during the weighing operation.
3. Vehicle speeding.

The Vehicle Display Window 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

A.4.6 Scale Manager

The Scale Manager will be 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, bridge, and gross weight based on Wisconsin regulations.
4. Allow operators to weigh trucks manually by accumulating up to 19 axles or axle groups

5. Provide the following features:
   a) Display shift counts
   b) Violations displayed in red
   c) Zero scale
   d) Reset scale
   e) Autoreleasing vehicles
6. Print requirements include:
   a) Site identification
   b) Individual weights (axles and axle groups)
   c) Gross weight
   d) Time and date
   e) WIM axle spacing
   f) Thumbnail image of vehicle
7. Will continuously show updated static scale counts for each shift for the day.
8. 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.

A.4.7 WIM Scale Auto-Calibration

To eliminate costly ramp calibrations, the mainline WIM scales shall electronically interface with the static scale. On a continuous basis the static scale shall ensure WIM system accuracy and calibration.

Calibration of each WIM scale shall be automatic and performed by electronic recording of WIM and static weights.

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 on each ramp. 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 E 1318-09. This information is to be easily accessible in reports to state personnel and shall be printed on a weekly basis throughout the continuous operating test and in everyday use of the weigh station afterwards.

The current accuracy requirements described in ASTM E 1318 for a Type III WIM will remain in effect. Vehicles shall be first weighed by the WIM System, then by the Static Scale Manager.

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 time and ending date and time. 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 Mainline and Ramp WIM systems.
2. Set up and configure the operation of the Mainline and Ramp Sorter Systems.
3. Initiate and reset traffic counting operation of the WIM Systems.
4. Perform maintenance functions of the Weigh Station systems.

B Materials

Material used in the construction of this equipment shall be of good commercial quality entirely suitable for the intended purpose. Material shall be free from all defects and imperfections that might affect serviceability of the finished product.

All disturbed areas are to be seeded and mulched.

B.1 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.

B.2 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.

C Construction

C.1 WIM System Functional Requirements

C.1.1 Mainline

C.1.1.1 WIM Scales

The accuracy of the WIM system will be in conformance with ASTM E 1318-09 "Standard Specifications for Highway Weigh-in-Motion (WIM) Systems with User Requirements and Test Method" performance requirements for a Type III system.

Sawcut and remove existing concrete pavement panel. Place Concrete Pavement 10-Inch. Grind the concrete roadway beginning 200 feet prior to the 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 the roadway meets the requirements of Section 6 of ASTM E 1318.

C.1.1.2 Camera System

The Camera System shall consist of the following system components:

1. Color and Black/White video camera
2. Illuminator system

The 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 locations. 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.

Camera poles and bases shall conform to the requirements of standard spec 672.

C.1.1.3 CMS

The Mainline Sorting System shall consist of the following system components:

1. 2 x Changeable Message Signs (CMS) each direction.
2. Detector loops as needed to track vehicle compliance.

The Sorting System shall direct vehicles to enter the weigh station or bypass the station, based on the results of the mainline sort decision.

The Sorting System shall consist of two CMSs that are sequentially switched by the Mainline WIM system. The Sorting System, 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 Sorting System, 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 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 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.

C.1.2 Ramps

C.1.2.1 WIM Scales

The accuracy of the WIM system will be in conformance with Type III ASTM E 1318-09 “Standard Specifications for Highway Weigh-in-Motion (WIM) Systems with User Requirements and Test Method” performance requirements for a Type III system.

Grind the new concrete pavement beginning 200 feet prior to the 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 E 1318-09.

C.1.2.2 Overheight Detection

An overheight vehicle detection system shall be installed at the mainline WIM system location. The overheight system shall be designed such that a potentially overheight vehicles are directed to enter the station and then sorted to the scale. The detection system shall detect objects that are at least 2 inches in diameter and 1 inch above the line of detection.

C.1.2.3 LCS

A Lane Control System (LCS) shall be installed on each exit ramp prior to the sorting point. Each Lane Control System consists of the following components:

- Two Directional Signals with Red "X", Green "ARROW" graphics.
- Support Structures and base to suspend the signals (as listed in a) above the lanes of travel.
- A pole, mast arm and base will provide support for signals.

The support structure and base will be designed to meet department requirements.

C.1.2.4 Scale Message VMS

Two message signs shall be located downstream of the static scale and mounted on overhead support on poles. All VMSs shall be constructed using the same technology.

The VMS mounted over the left lane shall display a static "LEFT LANE" sign above the VMS and shall have the following message options:

Message 1:
PULL ONTO
SCALE - in yellow/orange with animation

Message 2:
PULL FORWARD
SLOWLY – in yellow/orange

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/orange

Message 6:
RELEASE BRAKES – in yellow/orange

Message 7:
OK
GO AHEAD – in green

Message 8:
PARK IN LOT – in green

Message 9:
REPORT FOR
INSPECTION – in green

Message 10:
PULL INTO
BAY 1 – in green

Message 11:
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 above the VMS and shall have the following initial message options:

Message 1:
PULL INTO LOT – in red

Message 2:
OK GO AHEAD – in green

Message 3:
SLOW DOWN - in yellow with animation

Message 4:
30 MPH - in yellow/orange

The system shall have the capability to create or edit messages. A message shall be displayed for every commercial vehicle.

C.2 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 ¾-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.

C.3 System Acceptance

The WIM system shall be accepted subject to fulfilling the following conditions:

1. System review.
2. Acceptance tests (meeting WIM accuracy on a weekly basis).
3. Training.

C.3.1 System Review

The selected WIM vendor shall submit six copies of a system layout for each individual site. These layouts shall be submitted to the engineer for review and approval.

A preliminary on-site meeting shall be held for each site to discuss contractor's plans for the routing of conduits, cables, and placement of equipment.

C.3.2 Acceptance Tests

The WIM system, 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 engineer with all reports submitted to the engineer.

C.3.2.1 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 to the test specifications approved by the engineer. 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.

C.3.2.2 Site Acceptance Tests

After all the equipment and software have been installed at the site, run tests to ensure that all equipment operates as specified in contract documents. These tests shall be witnessed or conducted by the engineer within one week of the manufacturer notifying the engineer that the system is ready for testing.

The camera system shall be tested at the weigh station system site to verify that the images taken at daytime and nighttime are clear and integrated properly with the vehicle record from the weigh station system. 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, and properly integrated with the vehicle data received by the weigh station system.

C.3.2.3 Continuous Operating Test

Following successful completion of the site acceptance test, a continuous operating test (COT) shall be conducted for a period of 56 calendar days. During this period the weigh station and its weight sorter system shall operate under normal conditions and attain a level of service of 98.0% or better of the total station operating hours within any period of 56 consecutive days.

The WIM scale system shall be considered unavailable when:

1. A major system component completely fails which significantly degrade the performance or operation of the weigh station. This situation is said to have prevailed if either the WIM system or the communication system has failed.
2. More than one system component fails to operate or respond to operator commands and/or system automation for more than thirty minutes.
3. Weekly WIM accuracy is not met. The State shall have the capability to run this report on their own.

During the continuous operating test, the entire WIM system shall be fully operational under normal traffic conditions and operate trouble free for 56 consecutive days. During the continuous operating test the WIM accuracy test/database shall be printed by the engineer and met weekly as previously specified for the WIM system.

In the event that one of the above mentioned conditions persists and the specified availability cannot be achieved, the WIM vendor will be informed and problem(s) shall be corrected and the continuous operating test shall start over until 56 continuous days of trouble free operation are experienced. This re-start can only occur three times. In order for this test to be valid, the static scale must be fully operational for the 56-day period. The WIM vendor must leave the site prior to the start of the continuous test and may only return if a problem is encountered or accompanied by the engineer.

Payment:

1. Payment upon safe and secure delivery of all equipment at a storage location approved by the engineer	40%
2. Complete installation of the entire system	25%
3. Completion of calibration and burn-in	10%
4. Completion of the COT to the satisfaction of the engineer	25%

The continuous operating test will be the basis for acceptance or rejection of the WIM system 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 to the above payment schedule, agreed-to by the parties:

The department shall issue a certificate of final acceptance upon successful completion of the continuous operating test and training program.

This calibration/acceptance procedure follows latest version ASTM E1318 Standards. Calibration is to be performed by the running of one calibration truck. The five-axle, test vehicle should be of a tractor/trailer combination (3S2), complete with air ride suspension and a non-shifting static load. The truck will be loaded to within 90 to 100% of allowable gross vehicle weight for the road under test. The truck will be in excellent mechanical condition.

The calibration procedure is as follows:

1. The vehicle will be weighed at a government certified static weigh scale. The weight information on the front (single axle), drive (tandem axle group), and trailer (tandem axle group), should be recorded. The gross vehicle weight (GVW) of the vehicle will be calculated by adding the three weights together.
2. The distance between the five individual axles on the truck will be measured and recorded.
3. The test vehicle will make three test passes over the system under test at a selected speed which is indicative of the truck traffic at the site. Adjustments will be made by vendor personnel on site during this time to fine-tune the axle spacing, and weight output of the WIM system.
4. Once all initial adjustments have been made, the test vehicle will make an additional two test passes to confirm the accuracy of the adjustments. If all the readings fall within the latest version ASTM ranges for the WIM type under test, and vendor personnel do not feel that additional adjustments are required, the tests will continue. If this is not the case, additional adjustments will be performed and two more confirming passes will be made by the test truck.
5. The test truck should then make an additional ten passes at a selected speed that is indicative of the truck traffic at the test site.
6. Record all of the data and place it into a spreadsheet.
7. The mean error and standard deviation for all recorded measurements will be calculated at the end of the ten test passes. The calculations will be as follows:
   a) For weight measurements, the percent error for each test pass will be calculated using the following formula:
      [(WIM Weight - Static Weight)/Static Weight] x 100 = % error
   b) The mean error for each weight type (single, group, GVW) will be calculated as follows:
      % errors for single, group or GVW/# of samples = Mean error
      (Each weight type calculated individually)
   c) The error for individual axle spacings will be calculated using the following formula:
      10 of [(WIM Axle Spacings - Actual Axle Spacing)]/10 = Mean Axle Spacing Error
      (Each of the four axle spacings calculated individually)
8. All of the calculated errors will also be entered into the spreadsheet.
9. A check will be made of the calculated result against the acceptable range for the latest version ASTM WIM type under test. There will be one of two results:
   a) If 95% of all recorded test results, (single axles, axle groups, GVW, axle spacing) fall within the specified tolerance for the latest version ASTM E1318 WIM type under test then the system will have passed the requirements.
   b) If less than 95% of the calculated differences fall within the specified tolerance for the latest version ASTM E1318 WIM type under test then the system will be readjusted and an additional ten test passes will be required to retest the system.
10. The testing will continue until the system passes all criteria according to latest version ASTM E1318 standards

C.4 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 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 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.

Schedule the training program for the week prior to the start of the operations test. The cost for the first training sessions shall be included in the contract price. The department will provide classroom space for training session.

The departments will, from time to time review any future training requirements. The WIM vendor shall agree to provide future and additional training sessions upon receipt of requests from department. The department shall reimburse the WIM vendor the cost of providing additional training sessions on a per diem basis and at a rate agreed upon by the department at the time of the request. The department will provide classroom space for training session.

A WIM system review meeting shall be held six months after the system has been in full operation and annually thereafter. The review meeting shall include the WIM Vendor, State Patrol and WisDOT representatives and shall address comments, concerns and feedback regarding the WIM system operation and performance. The review meeting shall be arranged by the WIM Vendor and held on-site.

C.5 Warranty

The WIM vendor shall warrant all subsystems and system components as supplied and installed. This warranty and associated maintenance work are covered under a separate bid item.

The portable static wheel load scales shall each have a minimum 3-year warranty, to include parts, labor, shipping, updates, modifications and recalls.

D Measurement

The department will measure Weigh-In-Motion System as a single complete 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.0105.04	Weigh-In-Motion System	LS

Payment is full compensation for furnishing and installing all material and all utility hook-ups; performing all pavement grinding; and for furnishing all labor, supervision, equipment, calibrating and testing, warranties, 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, pavement grinding, load cell scales, portable static wheel load scales, piezoelectric sensors, system electronics (including all interface cards), high-speed internet, WIM cabinets and concrete pads, uninterrupted power supply, modem, manual console, printer, cabling, wiring, conduit, junction boxes, software, software licenses, cameras, camera poles, overheight detectors, lane control signs, "OPEN/CLOSED" inserts, VMS and CMS Signs and supports and training.

Sawing Existing Pavement, Sawing Concrete Pavement Full Depth, Removing Pavement, Pavement Dowel Bars, Concrete Pavement 10-Inch and Weigh-In-Motion System Warranty Maintenance will be paid under separate bid items.

47. Weigh-In-Motion System Warranty Maintenance, Item SPV.0105.05.

A Description

Provide warranty and maintenance service for the Weigh-in-motion scale system for a period of five years. This system includes four weigh-in-motion scales, cameras, sensors, 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 WIM System 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:

- All loops, WIM Scales, off scale sensors and piezoelectric sensors on site.
- Interface operations and system electronics.
- WIM cables, connectors, terminal strips and back-up batteries.
- Structures.
- Communication systems.
- Overview image cameras and equipment.
- Mainline sorting systems
- Ramp Lane Control Systems.
- Electrical power wiring and conduit.
- Weigh Station computer system.
    - Station Console
    - Scale Manager
    - Vehicle Display
    - Station PC
    - Override Console
- Printer (if existing not used).
- LED OPEN/CLOSED and Arrow ↖/CLOSED signs.

The warranty agreement shall include all:

- Mobilization, parts, labor and shipping.
- Equipment updates, upgrades, modifications and recalls.
- System interface and electronics updates, upgrades, modifications and recalls.
- Traffic control.
- Training for major system updates or upgrades.
- Lightning protection.

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, 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.

C.1 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 (Weigh-in-motion Scale System).
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 and video 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.
    a. Check and record all load cell readings (raw counts, millivolts, ohms and grounding) and provide in report.
    b. Perform linearity and repeatability tests then adjust as required. This test must be performed with a minimum 4,000 LBS certified test weights.
    c. Apply certified test weight for calibration and adjust as required. This test must be performed with a minimum 4,000 LBS certified test weights.
    d. Perform in-motion tests and adjust as required to comply with standards
    e. Provide print outs of the test.
17. WIM scale maintenance
    a. Lubricate load cell bolts.
    b. Remove all grease and apply new grease to O-rings and pins.
    c. Visually check scale platforms for visible damage.
    d. Remove cover plates, preload bolts, and anti-lift bolts and check platform for level or rocking.
    e. Remove platform.
    f. Check shims for damage and replace as needed.

g. Remove load pin from load cells and check gasket for wear.
h. Check torque on load cell bolts (390 feet lbs.).
i. Check all bolts in frame for tightness.
j. Reinstall platform, pre-load bolts torque (300 feet lbs.), and install anti lift blocks (1/32 gap).
k. 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.

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.0105.05	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.

48. Static Scale System, Item SPV.0105.06.

A General

This special provision describes furnishing and installing a motor truck scale system with dual tandem axle 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 manufacturer experienced in design, construction, and operation of equipment for the purpose required.

Data acquired from the Static Scale System described in this specification shall 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.

Scale and components shall be NTEP approved. 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 truck scale shall have a reinforced concrete deck.
   b. The concrete deck shall have a dual tandem axle capacity of 70,000 lbs on 4' centers.
   c. Each of the 22'11" x 12' wide and 15'3" x 12' wide platforms shall consist of a weighbridge assembly. The 42'11" x 12' wide weighting platform shall consist of two weigh assemblies.

2. The weighbridge to be a factory welded I beam design and all steel surfaces of the weighbridge to 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 used will be hot-dip galvanized according to ASTM A153.

3. The deck surface shall have 8-inch thickness minimum, colored concrete, having a minimum compressive strength of 4000 psi.
   a. Reinforcing steel to be epoxy coated, conforming to the requirements of standard spec 505. The deck shall be lined along the bottom with 3/16 STM-A36 steel plate or 18-gauge minimum galvanized deck sheeting, a reinforcing mat shall be set into place the length and width of the scale deck, and the deck channel is 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. Concrete to be A-FA or A-S, conforming to standard spec 501. 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 checking shall be done with a bumpering system. The scale shall not use the load cells as a checking device.

5. No manholes are allowed in the scale deck. One 8-inch diameter access hole with secured cover shall be provided in each scale platform. Galvanized steel sleeves shall be cast in the concrete deck. Scale pit access will be from an underground pit tunnel entrance from the building basement.

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 exposed surfaces shall be treated with a protective surface treatment conforming to standard spec 502.

B.2 Load Cells

Load cell so conform to the following:

1. The weighing elements shall be stainless steel, hermetically sealed load cells to guard against moisture ingression 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 or analog signal output. Proprietary load cell signal is prohibited.

6. The load cells shall be a minimum of 30 tons capacity each, and each cell shall have a stainless steel braided covering on the load cell cable.

7. All load cells shall be manufactured of stainless steel.

8. The scale shall have self-diagnostic capabilities able to identify load cell problems and failure.

9. The scale shall be able to identify each load cell individually.

10. The scale shall have the ability to view all of the load cells in the scale system simultaneously.

11. Diagnostics to have the capability to predict the failure of a cell before it actually happens to prevent down time. 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 undervoltage.
    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.

12. The design shall permit the individual load cells to be matched and the scale sections to be electronically calibrated.

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’-2"
Deck Material	Concrete, epoxy coated reinforcement
Scale Accuracy	0.1%
Weighbridge:	
Weighbridge Design	I-Beam
Number of Sections	7
Number of Modules	4
Reinforcing Steel Size	Welded mats Minimum W16 x16 on 4"x4" centers
Number of Manholes	0
Type of Checking	Check rods
Deck Concrete	Factory or site poured
Pit Coping included (Y/N)	Yes
Deck Channel included (Y/N)	Yes

Load cells:

Load Cell Type	Rocker Column
Rated Capacity	30T (66,000 lbs)
Safe Overload	200 %
Ultimate Overload	300 %
Safe Sideload	100%

Load cells:

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˚ 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
Display full color LCD	
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	Counter
Load Power Supply Limits	8-350 ohm cells, 16 - 1000 ohm
Load cell Input:	Digital or analog
Communication output ethernet	

Instrument Environmental Specifications:

Operating Temperature:	-10˚ to 40˚ C
Operating Humidity:	Non-condensing
Storage Temperature:	-20˚ to 60˚ C

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:	Laser printer
Cmmunication:	Ethernet
Ticket size:	8 ½” x 11”

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 Scale Pit Construction

This section describes scale 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 Scale Pit Construction Notes

All concrete work shall be performed in accordance to standard spec 501. All concrete shall be a minimum of 3500 psi @ 28 days. No fly ash will be allowed.

Reinforcing bars shall be epoxy coated, equal AASHTO M 31, grade 60, in accordance to standard spec 505. Bars shall be bent to conform with required details on drawings. Remove scaled, loose flaky rust, dirt, and other coatings that would impair bonding. Repair areas of damaged epoxy coating. Spaces bars properly and tie securely in position before placing concrete. Tack welding to keep reinforcing in place is not permitted.

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 shall extend beyond the pit wall a minimum of 2 inches.

For conduit runs up to 50 feet in length, use ¾-inch conduit. Avoid running conduit next to high voltage lines. Provide #10 copper ground lead at instrument location. Connect to 10-foot copper-clad round rod driven in moist earth. lf AC is required in the pit, it shall not run more than 24 feet in parallel to any cell cable.

Inside and center lines of dimensions must be maintained.

Scale pit walls and footing depths as indicated on plans are the minimum recommended where normal soil conditions prevail.

All scales require ground rods through the floor of the scale to the specified depth.

It is recommended that the piers be poured as shown on the plan.

Angle iron and coping are to be attached to the top wall form at the elevation as shown on the plan.

Bumper plates shall 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.

Excavation, foundation forms, rebel, and concrete are to be furnished by the contractor.

1500 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.

Work from center lines when erecting forms and placing foundation bolts.

The weighbridge shall be assembled, placed and blocked in the pit before load cells are installed.

Upon setting of scale decks and load cells, construction equipment shall not be allowed to drive upon the decks.

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

LED Graphic Display (168 x 128 or 16 lines @ 26 5x7 matrix size) Characters/line) LED Backlighting (Yellow)

Character sizes:	* 5 x 7 normal * 5 x 14 normal enhanced * 10 x 14 large * 15 x 2 1 extra large
Memory:	* 320k Battery backed non-volatile battery life, 2 years typically
Serial I/O:	* 20 mA Optically Isolated Remote display interface * COM 1 RS485 Bus to network up to 32 digitized interface * COM 2 Full 9-pin (Modem compatible) RS232C * COM 3 RS232C (4 Wire) * COM 4 Full 9-pin (Modem compatible) RS232C * COM 5 RS232C (4 Wire) or RS485
Flow Control:	* Hardware CTS/RTS, Software XON/XOFF.
Parallel I/O	* 4 Optically DC isolated inputs (10 mA) * 4 Optically isolated DC outputs TTL outputs
Keyboard:	* Oversized keypad, 9 Function keys 0 through 9 and decimal point Both keyboards can be operated In unison to complement each other
Clock:	* Real time clock, day of the week, 12-hour am/pm, month/day/year date format. Two or four digit year date selectable.

Peripherals:	* Type of Printer:	Laser printer
	* Communication:	Ethernet
	* Ticket Size:	Standard 8 ½" x 11"

Number of Scales:
* 1, 2, 3, 4
* Each scale can be set up with the following parameters:
* Scale units (lb, kg, ton, tonne)
* Weight Conversion (lb/kg, lh/ton, kg/tonne, ton/tonne)
* Zero enable, enable printer only after the weight is returned to zero.
* Motion bandwidth (0.5d, 1.01 2.0d, 3.0d)
* Division size (0.001 through 50)
* Digital filter (light, medium-light medium, heavy-medium, heavy)
* Dual Units
* Single range and Dual range Scale Capacities
* Calibration time and date stamp
* Configuration time and date stamp

Display rate:
* From 0.1 to 10 seconds in 0.1 second intervals

Zero:
* 2% or 100% Zero capability
* Can be completely disabled for tank weighing applications
* Additional load cell diagnostics are performed when the zero switch is operated.

Calibration:
* Keyboard
* Enter cell capacity, impedance and sensitivity for each cell in the scale group. The resultant span, assuming a good installation and accurate data, produces a calibration within +/- 0.1%. The final calibration is achieved through front panel trimming using the up/down arrow keys.
* Sectional Calibration: Apply a known weight (scale test truck) to each section of the scale. Apply a calibrated weight to the scale and trim from the instrument keyboard.

Load cell calibration: Apply a known weight to each cell in the scale group in the order prescribed by the instrument display, and trim to the final value from the instrument keyboard.

Tare:
* Can be disabled for gross weight only applications

Keyboard Tare:
* Tare data can be entered thorough either keyboard

Auto tare:
* Tares can be stored by direct weighing

Auto clear:
* Tares can be automatically cleared after printing

Tare expiration:
* Tares are time and date stamped to give a warning when their expiration date is up

Stored Tares:
* 100 stored tares
* 1 to 15 alphanumeric character ID
* Time and date stamped
* Weight data automatically converted to the appropriate weighing units
* Tare data files can be listed to a printer or viewed directly from the instrument

Products:
* 50 Product files
* 1 to 15 alphanumeric character ID
* Weight accumulator
* Conversion factor
* Number of decimal places for conversion factor
* 1 to 15 alphanumeric conversion factor legend
* Product data can be programmed to be entered in an inbound, outbound or Gross Tare Net operation
* Product data files can be viewed directly from the instrument

Field Names:
* 7 Field names can be given a 15 alphanumeric name to denote driver name, product grade, site location, etc.
* Each field name can be programmed to be entered in an Inbound, Outbound or Gross Tare Net (GTN) operation
* The first field name is stored as part of the transaction file

Incomplete:
* Up to 1648 Incomplete record storage
* Transaction records are stored temporarily as incomplete records
* Incomplete data files can be listed to a printer or viewed directly from the instrument

Transactions:
Up to 1648 transaction records, each record consists of:
* Inbound time (12 hour am/pm format)
* Outbound time (12 hour am/pm format)
* Outbound date (month/date/year/format)
* Gross weight
* Tare weight
* Net weight
* Product ID (15 Alphanumeric character ID)
* Conversion factor
* Conversion legend (15 Alphanumeric character ID)
* Loop # (15 Alphanumeric character ID)
* 1st Field name (15 Alphanumeric character ID)
* Ticket number

B.5.2 Environmental:

- Enclosure, 13 gauge 304 stainless steel for office or general industrial use
- Temperature, 14˚ F to 104˚ F, (-10˚C to 40˚C)
- Humidity, 95% relative humidity non-condensing
- Ventilation, none required
- Dust, non-conducting, non-corrosive
- Power, 100 VAC to 130 VAC or 200 VAC to 260 VAC, 501Hz/60Hz
- Power Consumption, 1 amp maximum at 115 VAC nominal
- Number of Cells, 16 standard, up to 32 by inquiry
- Scale can be located up to 1500 feet from the instrument

B.6 Static Scale Operation Specifications

1. Each load cell shall have a cable length of no more than 30 feet in stainless steel braided cable.

2. The scale instrument shall only receive digital information from the load cell assemblies.

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 graphic, alphanumeric LED back-lit color 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 12 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.

10. The instrument is to have self diagnostics built in that allow the technician to view all load cell outputs simultaneously.

11. 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.

12. The system shall have the ability to be 100% calibrated from within the scale house. No corrections or calibration adjustments at the scale through summing boxes are acceptable.

13. Summing boxes with potentiometers are not acceptable anywhere within the system.

14. Surge Voltage Protection on the system shall be optically isolated at each load cell, and transformer coupled from the instrument.

15. Scale is to have the ability to be analyzed via modem.

16. The scale instrument is to have the ability to be programmed via modem.

17. 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.

18. 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.

19. Modem service will be capable of performing a self test on all communications ports and report the current setup.

20. Original calibration values shall have the capability to be retrieved and stored via modem.

21. Original configuration values shall have the capability to be retrieved and stored via modem.

22. For non-commercial applications, scales shall have the capability to be set up and calibrated via modem.

B.7 Ticket Printer Requirements

Vendor to provide laser printer. Alternatively, an existing, on-site, networked printer may be utilized instead with the approval of the engineer. The ticket format shall include:

1. Wisconsin Department of Transportation, Division of State Patrol
2. Site location and ID
3. Date and time
4. Title (Static scale weights: Report)
5. Accumulated weights up to 19 weights
6. Total gross weight
7. Officer Name

B.8 Scoreboard Sign Requirements

Four displays shall be supplied. One to display the axle weights on each of the three weigh pads and one to display the GVW. Scoreboard may be mounted on the VMS support pole or on a separate traffic signal standard conforming to standard spec 657. Each display will meet the following specifications:

Display	Six digits, >/= 5 inches high
Viewing Distance	Up to 180 feet
Maximum cable length	1000 feet (20 mA 50 feet (RS232C)
Power	117 VAC + 15%m 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

B.9 Lightning Protection Specifications

1. A comprehensive lightning protection system shall be provided with the scale.
2. The system shall not require complicated wiring or devices to provide this protection.
3. Major scale components including load cells, scale instrument, and printer shall be included in the lightning protection system.
4. Grounding of all scale components including load cells, scale instrument, printer, and accessories shall be to one common point. Multiple ground point systems are not acceptable.
5. An AC line surge protector shall plug into a common electrical outlet and have receptacles for the scale instrument, ticket printer, and other scale accessories.
6. Each AC line surge protector required shall have isolated grounding, hospital grade duplex receptacles, and an internal 15-amp circuit breaker.
7. Verification of lightning protection system performance shall be available in writing from the manufacturer upon request

C Construction

C.1 Training

Upon completion, the vendor shall set up and conduct training for State Patrol personnel on the operation, maintenance and installation of the system components of the new static scale system. This training should occur during the WIM system training described above.

C.2 Warranty
The vendor shall warrant all subsystems and system components as supplied and installed. This warranty and associated maintenance work are covered under a separate bid item.

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

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.06	Static Scale System	LS

Payment is full compensation for furnishing and installing all materials; coordinating and making all necessary utility hook-ups; making the system operational; calibrating, testing; providing required training; 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, traffic signal standard and base, cabling, scale platforms, scale pit construction and excavation. Scope of work includes setting load cells and weighbridge, backfilling with existing excavated materials, any gravel to complete scale, any backfill or extra fill to complete scale.

49. Static Scale System Warranty Maintenance, Item SPV.0105.07.

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 $20,000. 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.0105.07	Static Scale System Warranty Maintenance	LS

Payment is full compensation for providing warranty and all maintenance services and emergency service for a period of 5-years, the load cell extended 5-year warranty and shall include all labor, tools, parts, shipping, mobilization, traffic control and incidentals necessary to perform the maintenance services.

50. Communications Tower, Item SPV.0105.08.

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 in accordance to the plans and the following specifications.

B General

Section 02010 – Subsurface Investigation

The project Geotechnical Report may be obtained from Robert Spoerl, Roadside Facilities Engineer, telephone (608) 266-8665, or by email robert.spoerl@dot.wi.gov.

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 Superior 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 Public Security and Communications.

Owner's Representative – For this project, the State of Wisconsin, Department of Transportation, Division of Transportation System Development, Northwest Region-Superior Office, Engineer

3. Related Work and 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 their 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 ¾ 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 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 in accordance 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 ¾ 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 in accordance to ACI 304 Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete and ACI 304.2R Placing Concrete be 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 which may 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 20º 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 90º 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 ¾-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 in accordance to ASTM C 143 and air content tests in accordance 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: Superior SWEF site to Bennett site, azimuth ±167°

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, Dane County Airport, 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 ½-inch radial thickness of ice coating on all members of the structure.

Analysis and design shall include ½-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 will furnish the dish antenna and dish mounting brackets for attachment to a 4½-inch outside diameter pipe. The department will furnish the coax cable and waveguide. 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 Public Security and Communications) 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 Public Security and Communications) 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 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 ¾-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 ¼-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 ¼-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: ¾- 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. 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 in accordance 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 in accordance 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 as a single complete lump sum unit of work, completed in accordance to the contract and accepted.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.08	Communications Tower	LS

Payment is full compensation for designing, furnishing all materials and all installation.

51. Holding Tanks, Item SPV.0105.09.

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. Weight of anchor =1.5 x tank volume in cubic feet x 62.4 pounds per cubic foot - 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	OHWM	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 as a single complete lump sum unit of work, completed in accordance to the contract and accepted.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.09	Holding Tanks	LS

Payment is full compensation for furnishing and installing all materials and equipment, excavation, backfill, permits.

52. Emergency Generator, Item SPV.0105.10.

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.0105.17 for materials information.

C Construction
Refer to article Section 26 32 00 - Packaged Generator Assemblies under SWEF Building, Electrical, SPV.0105.17 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.0105.10	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.

53. Construction Staking Initial Layout Parking Lot, SPV.0105.11.

A Description
This special provision describes construction staking required for 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 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.0105.11	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.

54. Construction Staking Subgrade Parking Lot, SPV.0105.12.

A Description
This special provision describes construction staking 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 single a 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.0105.12	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 stakes, lath, flags necessary to complete the work.

55. Construction Staking Concrete Pavement Parking Lot, SPV.0105.13.

A Description
This special provision describes construction staking 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 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.0105.13	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 stakes, lath, flags necessary to complete the work.

56. General Requirements for Building Construction.

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

1. SWEF Building, General Construction
2. SWEF Building, Plumbing
3. SWEF Building, Heating and Ventilating
4. SWEF Building, Electrical

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

Index of General Requirement Specifications

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Division 0 - Contracting Requirements

Section 00 72 00 – General Conditions

PART 1 – GENERAL

1.1 Referenced Document

A. The "General Conditions of the Contract for Construction" AIA Document A201 - 1997, published by the American Institute of Architects, is hereby made a part of the contract documents.

B. 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 (Vacant)

PART 3 – EXECUTION (Vacant)

End of Section 00 72 00

Division 1 - General Requirements

Section 01 11 00 – Summary Of Work

PART 1 - GENERAL

1.01 Related Documents

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

1.02 Definitions

"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.

"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.

"Standard Specifications": Refers to the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, Edition of 2015.

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

"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 Enforcement Facility to be constructed near Superior, 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 of a 9,970 SF single story facility of slab-on-grade floor, exterior masonry and steel framed roof structure. The building interior will be divided into State Patrol operations area and truck inspection area. The operations area will house offices, public lobby, public toilet rooms and support areas. The inspections area will include drive-through inspection bays, recessed inspection pits, and underground access to a static scale. Construction of a single level slab-on-grade structure with recessed inspection pits, and underground access to a static scale. Work includes, but is not limited to concrete footings and foundations, concrete slab-on-grade, recessed cast-in-place concrete floor recessed inspection pits, concrete masonry exterior cavity walls and interior partitions, precast hollowcore concrete plank, structural steel, steel open web joists, steel decking, interior architectural woodwork, foundation waterproofing, insulation, nailbase roof insulation, prefinished metal wall and soffit panels, fluid-applied air barrier membrane, standing seam metal roofing, flashing and sheet metal, gutters and downspouts, caulking and firestopping, metal doors and frames, sectional overhead doors, flush wood doors, aluminum entrances and storefront framing, door hardware, glass and glazing, insulated translucent panels, metal studs and gypsum board, tiling, acoustical tile ceilings, resilient flooring, carpeting, painting, high performance coatings, interior and exterior signage, toilet room accessories, fire extinguishers, metal lockers, safety netting, exterior sun control devices, flagpole, A/V equipment, window treatment, floor grids, furnishings, and fixed seating. The Inspections area will have a dry-pipe fire suppression system. The work will also include complete site utilities, plumbing, HVAC, electrical, and communications cable and equipment.

C. State of Wisconsin Department of Workforce Development Prevailing Wage Rates apply to the work described in Divisions 1 through 33.

1.04 Work Sequence and Schedule

The work sequence for the Divisions 1 through 33 will be the General Building Contractor's responsibility to coordinate with the owner, the supervising professional, and all required trades.

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

1.05 Permits

Local building permits shall be the responsibility of the general building contractor.

PART 2 - PRODUCTS (Vacant).

PART 3 - EXECUTION (Vacant).

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.

B. Substitutions: Substitutions may be used where 'approved equal' is specified. Substitutions must be approved by the supervising professional, 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 supervising professional in accordance to Section 01 33 00 – Submittal Procedures.

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

PART 2 – PRODUCTS (Vacant)

PART 3 – EXECUTION (Vacant)

End of Section 01 25 00

Section 01 32 00 – Progress Documentation and Procedures

PART 1 - GENERAL

1.01 Summary

This section is covered in the sections entitled "Prosecution and Progress" in the standard specifications and in the Roadway Special Provisions.

PART 2 – PRODUCTS (Vacant)

PART 3 – EXECUTION (Vacant)

End of Section 01 32 00

Section 01 33 00 – Submittal Procedures

PART 1 – GENERAL

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

1.2 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.
      1) 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.

1.3 QUANTITY OF SUBMITTALS

A. Number of Copies of SD-02 Shop Drawings and SD-03 Product Data.
    1. Submit six 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 samples, or one 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 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.

1.4 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.

1.5 SCHEDULING

A. Deliver submittals to the A/E on a timely basis that allows a review period of at least 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.

1.6 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 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.

1.7 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 in accordance to the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.8 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.

1.9 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 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.

PART 2 – PRODUCTS (Vacant)

PART 3 – EXECUTION (Vacant)

End of Section 01 33 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. In accordance 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 overcenter 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 yrade, 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 fire extinguishers on each floor level of the building, and one 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 (Vacant)

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 supervising professionals 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 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 (Vacant)

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 sitework, 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 supervising professional not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without supervising professional'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 supervising professional. 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 supervising professional 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 supervising professional 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 Supervising Professional.

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 supervising professional. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to supervising professional 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 supervising professional.
   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

Drawings and general provisions of contract, including general and supplementary conditions and other division-1 specification sections, apply to this section.

1.02 Summary

This section specifies administrative and procedural requirements for final cleaning at substantial completion.

Special cleaning requirements for specific elements of the work are included in appropriate sections of the specifications.

General project closeout requirements are included in section "Project Closeout."

General cleanup and waste removal requirements are included elsewhere in the standard specifications.

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.

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: (Vacant)

PART 3 – EXECUTION

3.01 Final Cleaning

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.

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 supervising professional.

Compliance: Remove waste materials from the site and dispose of in a lawful manner.

Where extra materials of value remain after completion of associated construction have become the department's property, dispose of these materials as directed.

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'

ÿ 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.

ÿ Remove tools, construction equipment, machinery and surplus material from the site.

ÿ Remove snow and ice to provide safe access to the building.

ÿ 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.

ÿ Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.

ÿ Wash concrete floors in unoccupied spaces.

ÿ Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.

ÿ 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.

ÿ Remove labels that are not permanent labels.

ÿ Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that can not 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.

ÿ Wipe interior surfaces of all cabinetwork including shelves, vertical dividers, and drawers.

ÿ Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.

ÿ Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

ÿ 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.

ÿ 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.

ÿ 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 supervising professional prior to requesting inspection for Substantial Completion.

Section 01 77 00 – Project Closeout Procedures

PART 1 - GENERAL

1.01 Related Documents

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

1.02 Summary

This section specifies administrative and procedural requirements for project closeout, including:

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

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

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

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 supervising professional. Inspection for substantial completion will not be conducted until the supervising professional is satisfied that these requirements have been met.

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.

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.

Inspection Procedures: Upon receiving the request for inspection, the supervising professional will either proceed with inspection or advise the general building contractor of unfilled requirements. The supervising professional 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 supervising professional 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 supervising professional or 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:

q Submit a list to the supervising professional 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.

q Notify the owner 30 days prior to any insurance coverage changes. Copy the supervising professional on this correspondence.

q Submit all warranties, maintenance contracts, and required operating instructions to the supervising professional for review and distribution to the owner. See section 01 78 23 for timing.

q 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 supervising professional for review and distribution to the owner.

q Submit record documents that show all changes made during construction, including all drawings, specifications, and addenda. Submit to the supervising professional for distribution to the owner.

q Deliver to the owner material replacement and maintenance stock as called for in the specifications.

q 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.

q Instruct the owner to operate and maintain all systems and equipment. Submit completed copies of checklist C from section 01 78 23 to the supervising professional.

q Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

q Complete the final clean up requirements, including touch up painting. Restore all damaged finishes. Submit completed checklist B to the supervising professional. See section 01 74 23.

q 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 supervising professional.

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

_____

General Building Contractor's Signature *Representing* *Date*

Return this completed, signed form to the supervising professional

1.04 Final Acceptance

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

Final Completion

General Building Contractor's Responsibilities:

1. 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.
2. Submit an updated final statement, accounting for final additional changes to the contract sum.
3. Submit a certified copy of the supervising professional'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 supervising professional.
4. Submit consent of surety to final payment.
5. Submit a final liquidated damages settlement statement.
6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

Re-inspection Procedure: The supervising professional 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 supervising professional.

Upon completion of re-inspection, the supervising professional 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 supervising professional or engineer with costs deducted from general building contractor balance.

PART 2 - PRODUCTS (Vacant)

PART 3 - EXECUTION (Vacant)

End Of Section 01 77 00

Section 01 78 23 – Operating and Maintenance Data/Owner Training

PART 1 - GENERAL

1.01 Related Documents

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

1.02 Summary

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.

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

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. Supervising professional will return 1 copy of draft and mark whether general scope and content of manual are acceptable.

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

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

PART 2 – PRODUCTS

2.01 Manuals, General

Organization: Organize manuals into suitable sets of manageable size.

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.

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.

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.

Content: In each manual, include information specified in individual specification sections and in this section.

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.

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.

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

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

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.

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.

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

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.

Provide as-installed color-coded piping diagrams, where required for identification.

1. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.
2. 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

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.

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.

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

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.

Complete Checklist C for each system requiring instruction or training, and submit to the supervising professional prior to requesting inspection for substantial completion.

CHECKLIST 'C' - OPERATING AND MAINTENANCE INSTRUCTIONS OWNER TRAINING and 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:

- ÿ Maintenance manuals.
- ÿ Record documents.
- ÿ Spare parts and materials.
- ÿ Tools.
- ÿ Lubricants.
- ÿ Fuels.
- ÿ Identification systems.
- ÿ Control sequences.
- ÿ Hazards.
- ÿ Cleaning.
- ÿ Warranties and bonds.
- ÿ Maintenance agreements and similar continuing commitments.

ÿ As part of instruction for operating equipment, demonstrate the following procedures:

- ÿ Start-up.
- ÿ Shutdown.
- ÿ Emergency operations.
- ÿ Noise and vibration adjustments.
- ÿ Safety procedures.
- ÿ Economy and efficiency adjustments.
- ÿ 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 supervising professional 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

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

This section includes administrative and procedural requirements for project record documents.

Project Record Documents required include the following:

1. Marked-up copies of contract drawings.
2. Marked-up copies of specifications and addenda.

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.

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 supervising professional's inspections.

1.03 Record Drawings

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 supervising professional'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.

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 supervising professional 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

During the construction period, maintain one 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 supervising professional 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

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 supervising professional for the owner's records.

PART 2 - PRODUCTS (VACANT)

PART 3 - EXECUTION

3.01 Recording

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

2. SWEF Building, General Construction, SPV.0105.14.

A Description

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

Division 03 – Concrete
Division 04 – Masonry
Division 05 – Metals
Division 06 – Wood, Plastics, and Composites
Division 07 – Thermal and Moisture Protection
Division 08 – Openings
Division 09 – Finishes
Division 10 – Specialties
Division 11 – Equipment
Division 12 – Furnishings
Division 31 – Earthwork
Division 32 – Exterior Improvements
Division 33 – Utilities

B Measurement

The department will measure SWEF Building, General Construction as a single lump sum unit of work, acceptably completed.

C Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.14	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

Part 1 - General

1.01 Work Included

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

B. Section includes:

1. Formwork, shoring, bracing, and anchorage
2. Concrete reinforcement, anchor bolts, waterstops and accessories
3. Installation of perimeter and underslab insulation
4. Granular base under slab-on-grade
5. Underslab vapor retarder barrier
6. Installation of subdrainage sleeves through footings and foundation walls
6. Cast-in-place concrete

1.02 Work Installed but Furnished Under Other Sections

Section 05 12 00 – Structural Steel: Anchor bolts
Section 07 21 13 – Board Insulation: Perimeter and underslab insulation

1.03 Related Sections

Section 05 12 00 – Structural Steel: Anchor Bolts
Section 07 13 13 – Elastomeric Sheet Waterproofing
Section 07 21 13 – Board Insulation: Perimeter insulation and protection board.
Division 22 - Plumbing
Division 23 – HVAC: In-Slab Radiant Heating
Division 26 – Electrical: In-slab and underslab conduits and electrical equipment.
Section 31 23 00 – Excavation and Fill
Section 32 13 13 – Concrete Sidewalks

1.04 References

ACI 301 – Specifications of Structural Concrete for Buildings
ANSI/ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement
ANSI/ASTM A497 – Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A615 – Deformed and Plain Billet-Steel for Concrete Reinforcement
ASTM C 33 - Concrete Aggregates
ASTM C94 – Ready-Mixed Concrete
ASTM C150 – Portland Cement
ASTM C260 – Air Entraining Admixtures for Concrete
ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete
FS TT-C-800 0 Curing Compound, Concrete, for New and Existing Surfaces

1.05 Submittals

Product data for fiber reinforcement**,** forming accessories, admixtures, patching compounds, waterstop vapor barrier, expansion joint filler, curing compounds, dry-shake finish materials, and others as requested by the architect.

Shop drawings for fabricating, bending, and placing concrete reinforcement and supports; type, size and location of all accessories (bar schedules, stirrup spacing, and diagrams of bent bars, arrangements and accessories), bar laps on strings of horizontal bars (all lap splices shall develop full strength of bar unless lesser laps permitted by drawings), manufacturers specifications and installation instructions for splice devices. Comply with ACI 318 Manual of Standard Practice for Detailing Reinforced Concrete Structures.

Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement.

Welding Certificates: Copies of certificates for welding procedures and personnel.

Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials.

Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Vapor retarders.
5. Curing materials.

1.06 Quality Assurance:

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.

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

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.

The general contractor shall employ a separate testing laboratory to evaluate concrete delivered to and placed at site.

1.07 Testing and Quality Control Services

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 in accordance to requirements of the Contract Documents.

Quality Assurance

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

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.

Laboratory Responsibilities

Perform sampling and testing of concrete work as described under spec Section 03 30 00–Cast-In-Place Concrete, Art.3.09 – Field Quality Control.

1.08 Delivery, Storage, and Handling

Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.
2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963/D 3963M.

Part 2 - Products

2.01 Form Materials:

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.

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 factory treated with chemically reactive release agent and factory sealed edge sealant.

Manufacturers

a. Simpson B-Matte® 333
b. Fourply, Inc. MOO 333
c. Royal Plywood Co. PacForm MDO™

Formed Surfaces Concealed From View

Wood: Clean straight lumber dressed on face and edges, nominal 1" thickness or plywood 5/8" or ¾" thick conforming to EXT-DFPA or metal forms smooth and as large size as possible.

Form Ties

1. For Unexposed Concrete: Adjustable length removable or snap-off type fabricated to leave holes no larger than 1-inch in diameter in face of concrete with breakpoint 1-inch or more from surface.
2. For Exposed Concrete: Snap-off type (break point 1 inch 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.

PVC Sleeves: Where indicated on the plans, furnish and install PVC sleeves through footings and foundations for routing of PVC subdrainage system per Section 33 46 16.

2.02 Granular Base Under Slab-On-Grades

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

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

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

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

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.

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

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

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

2.04 Reinforcement Accessories

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 of CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

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.

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

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

Portland Cement: ASTM C 150, Type 1.

Fly Ash: Class C, ASTM 618.

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).

Steel and Synthetic Fiber Reinforcement: Steel and synthetic fibers engineered and designed for use in composite floor slabs, complying with ASTM C-1116, Type 1 at a minimum dosage rate of 25 lbs./cu. yd. and possessing an average residual strength of at least 92 psi, when tested in accordance to ASTM C 1399.

1. Products: Approved products are limited to the following:
    a. Novomesh 850 HHP Fibers; SI Concrete Systems.
    b. Dramix Duo 150; Bekaert Corporation.

2.06 Admixtures:

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. Xypex C-500, XYPEX Chemical Corp.
    a. Applicable to the following below-grade foundation walls:
        Scale Tunnel 001, Stair 002, Recessed Inspection Pits 117A and 117B

2.07 Related Materials

Expansion Joint Filler

1. Flexible, lightweight, nonstaining, 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 where slabs abut walls, columns, or other vertical surfaces.
4. Manufacturer: W.R. Meadows 'Deck-O-Foam'

Waterstop

1. Provide 4" wide x 3/16" thick flat ribbed flexible PVC (polyvinyl chloride) waterstop equal to Greenstreak Style No. 781 or equivalent profile as manufactured by BoMetals, Inc.; Powder Springs, GA.
2. 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.
3. Performance Requirements as follows:

Property	Test Method	Required Limits
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lb/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 Brittlenes	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 7day Weight Change Hardness Change	CRD-C 572	 Between -0.10% / +0.25% +/- 5 points

4. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
5. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.

Vapor Retarder

1. 15-mil sheet type plastic membrane meeting all requirements of ASTM E1745 Classes A, B and 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

Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

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 days. Add moisture daily to maintain surface in a damp condition.

Membrane-Forming Curing Compound: ASTM C 309, Type I Class A. Provide 2 coats. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 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. Cure and Hard, Symons Corporation.
   b. Kure-N-Seal, Sonneborn-Chemrex.
   c. Dayton J-20 Day-Chem Cure and Seal.
   d. TK Products AS-1 Achro Seal 1315

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 and Seal.

Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Dayton J-74 Sure-Film.
2. Pre-approved equals.

Sealer: Where sealer ("sealed slab") is noted on Room Finish Schedule. Apply per Manufacturers instructions and at manufacturers recommended application rates. Provide manufacturers five year guarantee against dusting.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Lapidolith - Sonneborn Chemrex.
   b. Fluohard - L & M Construction Chemicals.
   c. Dayton J-15 Dry-Chem Hardener
   d. Son-No-Mar VOC, Light Gray - Sonneborn Chemrex.

Pipe Sleeves: Schedule 40 PVC piping

2.08 Mix Proportioning

Ready-Mix Concrete: Measure, mixed and delivered in accordance to ASTM C 94.

Mix Design Schedule:

Use	Min. Compress. Strength @ 28 days	Slump (Before Plasticzer)	Max Aggr Size	Min lbs of cement per C.Y.	Air Entran. %+/- 1/2%	W/C Ratio
Footings	3,000 PSI	5”	1 ½”	423 lb.	4.5%	.68
Walls/Piers	4,000 PSI	4”	¾”	541 lb	None	.57
Interior Office Slab-On-Grade	4,000 PSI	3”	1 ½”	541 lb	None	.57
Interior Traffic Slab-On-Grade	4,000 PSI	3”	1 ½”	541lb	6.0 %	.45
Exterior Slab-On-Grade	3,500 PSI	3”	¾”	517 lb.	6.0 %	.48
Bond Beams	3,000 PSI	4”	3/8”	517 lb.	None	.68

Air entrained concrete: Use for all exterior walls, exterior slabs, walks, platforms, ramps, steps and all other concrete exposed to freezing and thawing.

Revise sample figures below (from aci 318) to suit project. Delete types not required. If using a concrete schedule for strengths above 4000 psi, establish proportions based on ACI 318--section 4.3.

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 ½ inch.
2. Concrete without admixtures: 5 inch slump plus or minus 1 ½ inch and minus 1 inch.
3. Concrete containing high-range water-reducing admixture (super plasticizer): Not more than 8 inches plus or minus 1 ½ inches.

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.

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.

Use water-reducing, accelerating, and retarding admixtures that have been tested and accepted in mix designs in strict compliance with manufacturer's directions.

Job-Site Mixing: Use drum-type batch machine mixer, mixing not less than 1-1/2 minutes for 1 CY or smaller capacity. Increase mixing time at least 15 seconds for each additional CY.

Add fibrous concrete reinforcement to concrete materials at the time concrete is batched, in amounts in accordance to approved submittals for each type of concrete required. Mix concrete in strict accordance with fiber reinforcement manufacturer's instructions and recommendations for uniform and complete distribution.

Part 3 - Execution

3.01 Formwork

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

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.

Install welded wire fabric in lengths as long as practicable; lap at least one full mesh and lace splices with wire.

3.03 Joints

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

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 Installation of Pipe Sleeves

The Concrete contractor shall install PVC pipe sleeves through foundation walls and footings where indicated on the drawings for plumbing lines and drain tile piping. Set pipe sleeves through formwork. Confirm exact elevations of plumbing lines with plumbing contractor.

3.06 Concrete Placement:

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.
        2) Protect adjacent finished materials/surfaces from concreting operations. Repair/replace any damaged surfaces/materials at no cost to owner.

3.07 Concrete Slab Flatness and Levelness Tolerances

Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed ¼-inch.

Concrete floor slabs surrounding floor drains shall be sloped ¼-inch per foot from “finished floor elevation” unless noted otherwise.

3.08 Finish of Formed Surface

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.

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. 3.08 above. Grind smooth surface defects that would telegraph through applied floor covering system.

Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.09 Curing / Sealing

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.

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.

3.10 Field Quality Control

Coordinate sampling and testing during concrete placement by General Building Contractor's independent testing agency as follows:

Site Testing

1. Testing firm will take cylinders and perform slump and air entrainment tests in accordance 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.

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

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

Section Includes:

1. Precast concrete hollow core plant.
2. Connections and bearing strips.
3. Grouted precast plank joints.
4. Precast concrete wall coping.

1.02 Related Sections

Section 04 05 13 – Masonry Mortar and Grout
Section 04 20 00 – Unit Masonry.
Section 07 92 00 - Sealants

1.03 References

Reference Specifications: Comply with recommended practices and procedures of the referenced specification standards and with the modification as specified herein.

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.

American Concrete Institute (ACI):

1. ACI 318-building Code Requirements for Reinforced Concrete.
2. ACI 301-Specifications for Structural Concrete Buildings.

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 and Performance Qualifications

1.04 Submittals

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.

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.

State Submittals: Provide six 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 of $300 made out to 'Wisconsin Dept. of Safety and Professional Services'.

Fabricator's Installation Instruction: Indicate special procedures required for installation and or temporary shoring requirements

1.05 Design Requirements

Design Standards: Comply with ACI 318-Building Code Requirements for Reinforced Concrete and MNL- 126 Manual for Design of Hollow Core Slabs.

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 ¼ inch of the camber indicated on the approved shop drawings.

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

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

Fabricator Qualifications: A qualified fabricator firm shall participate in PCL's Plant Certification program and is designated a PCI plant for Group C, Category CI. 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

Form Materials: Provide formwork of sufficient strength to withstand pressures due to concrete operations and, when prestressed, pre-tensioning and de-tensioning 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.

Provide formed openings in precast units for holes larger than 10 inches in diameter.

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 250 unless otherwise indicated.
5. Steel Inserts and Connections: ASTM A 36, galvanized after fabrication where exposed to weather.

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.

Air-Entraining Admixture: ASTM C 260.

Water-Reducing Admixture: ASTM C 494, type as required.

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.

Produce standard-weight concrete consisting of Portland cement, aggregates, admixtures, and water to produce the following properties.

Compressive strength not less than 5000 psi at 28 days. Total air content not less than 4 percent nor more than 6 percent.

Color Additive (Precast Concrete Wall Coping): Bayferox inorganic, synthetic iron oxide pigments, lime proof and non-fading, conforming to ASTM C-979. Amount of pigment shall not exceed 10% by weight of the cement used.

2.03 Fabrication – Precast Hollow Core Plank

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.

Concrete Placement: Comply with PCI MNL 116.

Place concrete in continuous operation to prevent formation of seams or planes of weakness in precast units, using internal and external vibration for consolidation.

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.

Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.

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.

Cure precast units by low-pressure stream, steam vapor, radiant heat and moisture, or other similar process.

Delay de-tensioning of prestressed units until concrete has attained at least 75 percent of design ultimate compressive strength.

2.04 Fabrication – Cast Concrete Wall Coping

Provide precast wall coping in profile and lengths indicated on the drawings.

Aggregate:

1. Course Aggregate: Carefully graded and washed gravel or stone conforming to ASTM C-33, 3/8” maximum size.
2. Fine Aggregate: Carefully graded and washed natural concrete sand conforming to ASTM C-33.

Finish: Smooth

Color: Match color of CMU #4 specified under Section 04 20 00.

Part 3 – Execution

3.01 Preparation
Prepare support devices for the erection procedure and temporary bracing.

3.02 Erection – Precast Hollow Core Plank
Erection: Do not erect precast units until concrete has attained its design ultimate compressive strength.

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.

Provide necessary bolts, clips, hangers, and other accessories required for installation of precast units, galvanized after fabrication.

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.

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.

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 and Grout

Part 1 - General
1.01 Summary
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

Section Includes:

1. Preblended mortar
2. Preblended grout mixes.
3. Non-shrink grout

1.02 Related Sections

Section 04 20 00 – Concrete Unit Masonry
Section 05 50 00 – Metal Fabrications
Section 08 11 13 – Hollow Metal Doors and Frames

1.03 References

Preblended Mortars

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 C476 Standard Specification for Grout for Masonry.
7. ASTM C595 Standard Specification for Blended Hydraulic Cements.
8. ASTM C780 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. ASTM C926 Standard Specification for Application of Portland Cement-Based Plaster.
10. ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete.
11. ASTM C1329 Standard Specification for Mortar Cement.

Preblended 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

Non-Shrink Grout:

1. ASTM C 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
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 or Hydraulic Cement Mortar.

6. ASTM C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency.

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

Design and Performance Requirements: Provide mortar and grout mixes which have been selected, manufactured, mixed and installed to comply with the standards referenced herein.

1.05 Submittals

Product Data: Submit manufacturer's product data and installation instructions.

Samples: Submit two samples of selected mortar color.

1.06 Delivery, Storage and Handling

Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

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 of 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

Environmental Requirements:

1. Do not build or apply mortar products on frozen substrates. 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 Preblended Mortar Mixes and Grout Mixes

Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction.

Hydrated Lime: ASTM C207, Type S.

Mortar Cement: ASTM C 1329.

Masonry Cement: ASTM C 91.

Aggregate for Mortar: ASTM C 144, Fine Type, except for joints less than ¼ inch use aggregates graded with 100 percent passing a No. 16 sieve.

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.

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

Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Provide standard gray mortar at masonry walls of standard gray CMU.
2. Provide colored mortar to match colored masonry units.

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.

Grout Compressive Strength: Grout shall have minimum compressive strength of 3000 psi at 28 days when proportion in accordance to ASTM C 1019.

Grout Slump: The grout shall be mixed to a slump of 8 to 11 inches as determined by ASTM C 143/C 143M.

Non-Shrink Grout: ASTM C1107.

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'

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.

Water: Potable.

Part 3 - Execution

3.01 Manufacturer's Instructions

Comply with the instructions and recommendations of the mortar and grout manufacturer.

3.02 Examination

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.

3.03 Mortar Mixing

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 who will outline hand-mixing procedures.

Observe mixing times of 4-5 minutes, consistent from batch to batch.

Use clean, potable water, add the maximum amount consistent with optimum workability.

Maintain a uniform water/cement ratio.

Rinse out mixer following each batch.

At the end of the day, thoroughly rinse the mixer to avoid contamination of future mortar batches.

Retemper mortar by adding mixing water only to replace water lost due to evaporation.

Do not retemper colored mortars.

Discard mortar 2.5 hours after initial mixing.

3.04 Installation

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 Profile: Concave unless noted otherwise.
5. Cure mortar a minimum of 28 days.

Grout:

1. Install grout in accordance to manufacturer's instructions.
2. Work grout into masonry cores and cavities to eliminate voids.
3. Grout hollow metal door and borrowed light frames where installed in masonry openings.
4. For masonry core fill grout applications, comply with the requirements of ASTM C926.

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

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.

End of Section 04 05 13

Section 04 20 00 - Unit Masonry

Part 1 – General

1.01 Scope of Work

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

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

Section 03 41 00 – Precast Concrete
Section 04 05 13 – Masonry Mortar and Grout
Section 05 50 00 – Metal Fabrications: Loose Steel Lintels
Section 07 21 19 – Foamed Masonry Core Fill
Section 08 11 13 – Metal Doors and Frames: Door frames set in masonry openings.

1.03 References

Unit Masonry Standard: ACI 530-05/ASSCE 50-5/TMS 402/05 Building Code Requirements for Masonry Structures and ACI 530.1 -05 /ASCE 6-05/TMS 602/05 Specifications for Masonry Structures.

1.04 Submittals:

General: Submit each item in this article according to the conditions of the contract and Division 1 specification sections.

Product Data: For each different masonry unit, accessories, integral mortar water repellant and other manufactured product specified.

Samples for selection of the following:

1. Full-sized unit masonry samples showing the full range of colors and textures available for each different exposed masonry unit required.
2. Colored masonry mortar samples showing the full range of colors available.
3. Weep holes/vents.
4. Through-wall flashing.

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.

Material certificates for the following, signed by manufacturer and contractor, certifying that each material complies with requirements.

1. Each different cement product required for motor and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
2. Each material and grade indicated for reinforcing bars.
3. Each type and size of joint reinforcement.
4. Each type and size of anchors, ties, and metal accessories.

Material test reports from a qualified independent testing agency, employed and paid by contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:

1. Mortar complying with property requirements of ASTM C 270
2. Mortar complying with BIA M1.
3. Grout mixes. Include description of type and proportions of grout ingredients.
4. Masonry units.

1.05 Fire Performance Characteristics

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

Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.

1. For Concrete Unit Masonry: As follows based on net area:
   a. f'm = 2,000 psi.

1.07 Quality Assurance

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.

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 8 feet long by 12 feet high by full thickness, including face and backup wythes as well as accessories.

   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.

Testing Agency Services: Sample and test in accordance 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.

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

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.

Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.

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.

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.

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.

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

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

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. 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.

Ground Face Concrete Masonry Units (GFCMU)

1. "Ultra" Burnished Masonry Units as manufactured by Premier Block Corporation, Eau Claire, WI. All units shall conform to ASTM C90-00 moisture controlled and shall have a high density polished groundface 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 byt e burnished masonry manufacturer.
   a. Application: Single coat, spray apply, 6 mil WFT (2mil DFT). Application shall be conducted in the presence of block manufacturer's representative.

Schedule of CMU Exposed Faces:

Mark	**Face Texture**	**Nom.Face Size (ht.x width)**	**Color***	**Bond Pattern**
CMU-1	Smooth Face	8" x 16" and 4" x 16"	Standard Gray	Stacked Bond
CMU-2	Single Sided Ground Face CMU w/Single Score	8" x 16"	'Antique White'	Stacked Bond
CMU-3	Single Sided Ground Face CMU w/o Score	8" x 16" and 4" x 16"	'Antique White'	Stacked Bond
CMU-3A	Double Sides Ground Face CMU w/o Score	8" x 16"	'Antique White'	Stacked 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 CMU as manufactured by Premier Block.)

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 and Grout

2.04 Reinforcing Steel:
Steel Reinforcing Bars: Grade 60, Billet steel complying with ASTM A 615 (ASTM A 615M).

2.05 Joint Reinforcement
General: Provide joint reinforcement formed from the following:

Galvanized carbon-steel wire, ASTM A 153, Class B-2, hot-dipped galvanized at interior and exterior walls.

Manufacturers
1. Hohmann & Barnard, Hauppauge, NY
2. Heckman Building Products, Inc., Melrose Park, IL
3. Wire-Bond, Memphis, TN

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).

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.

For multi-wythe masonry cavity wall assemblies, provide ladder design with eyehooks 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
Description: 1-1/2-inch wide, hot-dipped galvanized corrugated buck anchors with 1-1/2-inch long standard bend and 5/16-inch predrilled holes.

Manufacturers

1. Hohmann & Barnard, Inc. Model #345 Corrugated Buck Anchor
2. Heckman Building Products Model #187

2.07 Adjustable Anchors For Connecting To Steel Frame

General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resists tension and compressive forces perpendicular to plane of wall. Assemblies shall consist of 11-gauge hot-dipped galvanized steel channel with 12-gauge hot-dipped galvanized wire anchors to fit within channel.

Manufacturer

1. Hohmann & Barnard, Inc. Hauppauge, NY.
2. Heckman Building Products, Inc. Melrose Park, IL.
3. Wire-Bond, Memphis, TN.

2.08 Miscellaneous Anchors

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.

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.

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

Composite Membrane Through-wall Flashing (See drawings for type/locations):

1. Manufacturers
   a. Carlisle Coatings & Waterproofing, Inc., 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.

Metal Flashings
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 Masonry Drainage And Ventilation System (Single-Wythe Masonry)
At single-wythe exterior masonry walls, provide plastic flashing-pans made from high-density recycled polypropylene with built-in weep spouts.

Manufacturer: Blok-Flash® by Mortar Net USA, Ltd., or approved equal.

2.11 Weep Vents
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.
2. Manufacturer:
    1. Archovations, Inc. *'CavClear Weep Vents'*
    2. Mortar Net® USA Ltd.
    3. Sandel Construction Solutions
    4. Approved equal

2.12 Cavity Wall Insulation
Where indicated on the drawings, provide rigid cavity wall insulation as follows:

1. Insulation Type: Closed cell polyisocyanurate rigid foam with acrylic coated aluminum foil facer per ASTM V1289, Type 1, Class 1. NFPA tested for exterior wall assembly specified.
2. Thickness: As shown on drawings
3. R-Value (Aged), ASTM C518: 6.5 per inch
4. Compressive Strength (ASTM D1621): 25 psi
5. Water Absorption (ASTM C272): <0.1% by volume
6. Flame Spread (E84): <25
7. Smoke Developed (E84): <450

Manufacturers

1. Atlas Wall CI Board – EnergyShield®PRO
2. Hunter Panels Xci 286 Foil Faced
3. Firestone Building Products Enverge™CI Foil
4. Approved equal

2.13 Accessories
Manufacturers:

1. Hohmann & Barnard, Inc. 'Mortar Net'
2. Archovations, Inc. 'CavClear Masonry Mat'
3. Sandel Construction Solutions
4. Approved equal

Mortar/Grout Screen: ¼" 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.

Mesh Type Mortar Stop
1. 1-inch high density polyethylene
2. Manufacturers:
   a. Hohman & Barnard, Inc. 'Mortar Net'
   b. Archovations, Inc. 'CavClear Masonry Mat'
   c. Approved equal

Closed Cell Neoprene Sponge
1. 3-inch wide x ½-inch thick sponge strips conforming to ASTM D-1056 Grade 2A1 with adhesive backing.
2. For use at vertical expansion/control joints in masonry veneer.
3. Manufacturer: Hohmann & Barnard, Inc. *Series #NS*

2.14 Sand Filled Cores
Where indicated on the drawings, fill CMU cores with clean masons sand.

2.15 Date Stone
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.

Cut Stone Source Options
1. Indiana Limestone, smooth finish, cut to profiles shown.
2. Winona Dolomite limestone as detailed, Biesanz Stone Co., Winona, MN
3. Anamosa Limestone, Weber Stone Co., Anamosa, IA

Color: Light Buff (submit sample)

2.16 Masonry Cleaners
Manufacturers:
1. Prosoco, Inc. *Sure Klean 600* Detergent
2. Diedrich Technologies 222
3. Chemical Products Industries, Inc.
4. Approved equal

Application must receive prior approval from concrete block manufacturer.

Part 3 - Execution
3.01 Examination

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.

Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.02 Pre-Installation Conference

At least two weeks before the start of above-grade masonry work, 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 contractor, Mason contractor, Flashing Installer, CMU Producer and/or the manufacturer of the CMU/Mortar Integral Water-Repellent Admixture. Advise the supervising professional of the scheduled meeting date.

3.03 Installation, General

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.

Build chases and recesses to accommodate items specified in this and other sections of the specifications.

Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to the opening.

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.

Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

Glass unit masonry components shall be installed as a component of concrete masonry unit wall assemblies as detailed using identical mortar and continuous wall reinforcing as specified.

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

Variation from Plumb: For vertical lines and surfaces of columns, walls, and arises, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), nor 3/8 inch in 20 feet (10 mm in 6 m), nor ½ inch in 40 feet (12 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor ½ inch in 40 feet (12 mm in 12 m) or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

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.

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 ¾ inch in 40 feet (19 mm in 12 m) or more.

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).

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

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.

Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

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.

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.

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.

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.

Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

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.

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.

Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above and as follows:

Install compressible filler in joint between top of partition and underside of structure above.

3.06 Installation – Mortar and Grout

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 Profile: Concave unless noted otherwise.
5. Cure mortar a minimum of 28 days.
6. 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.'
7. Mortar Joint Profiles shall be revised to read as follows:
8. Mortar Joint Profiles
    a. Exterior Masonry: Concave
    b. Interior Ground Face CMU: Raked joint
    c. Standard gray CMU: Concave

Grout:

1. Install grout in accordance 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.

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.

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.

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

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 8-inches o.c. vertically for all stacked bond CMU.

3.08 Adjustable Veneer Ties

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 ¼-inches.

3.09 Weeps and Vents

Install weep holes in veneer at 24 inches on center horizontally above through wall flashing at bottom of walls.

Install cavity vents at top of each cavity space, below shelf angles and at the same spacing in veneer at on center horizontally.

1.10 Cavity Behind Veneer

Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes.

Build outer wythe to permit installation of cavity insulation and air/vapor barrier adhesive.

3.11 Masonry Flashings

Extend flashings under veneer, turn up minimum 8 inches seal to sheathing over wood stud back-up.

Lap end joints minimum 6inches and seal watertight.

Use flashing manufacturer’s recommended adhesive and sealer.

3.12 Control and Expansion Joints

Do not continue horizontal joint reinforcement through control and expansion joints.

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

Protect top of masonry walls daily.

3.14 Final Cleaning:

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.

1.2 Related Sections

A. Section 04 05 13 – Masonry Mortar & Grout
B. Section 04 20 00 – Unit Masonry
C. Section 07 92 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 C33-Standard Specification for Concrete Aggregates
D. ASTM C 150 – Standard Specification for Portland Cement
E. ASTM C 173 – Standard Test Method for Air Content of Freshly Mixed Concrete
F. ASTM C 1194 – Standard Test Method for Compressive Strength of Architectural Cast Stone

G. G. ASTM C 1195 – Standard Test Method for Absorption of Architectural Cast Stone
H. ASTM C 1364 – Standard Specification for Architectural Cast Stone
I. I. ASTM C 2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
J. 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.
B. Wet Cast Concrete Products – manufactured from measurable slump concrete.
C. Wet casting method: manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.5 Submittals: Comply with Section 01 33 00 – Submittal Procedures.
A. 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.
B. 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.

1.6 Quality Assurance
A. Standards: Comply with the requirements of the Cast Stone Institute® Technical Manual and the project specifications.

Part 2 – Products

2.1 Manufacturers
A. American Artstone Company, New Ulm, MN
B. MidCon Products, Inc., Hortonville, WI;
C. Architectural Cast Stone, Inc., Wichita, KS

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. Water – Potable
F. 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.

G. 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 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.

2.4 Reinforcing
A. Minimum reinforcing shall be 0.25 percent of the cross section area.
B. 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.

2.5 Manufacturing Tolerances
A. Cross section dimensions shall not deviate by more than ±1/8 in, whichever is greater, not to exceed ±1/4 in.
B. Location of dowel holes, anchor slots, flashing grooves, false joints, and similar features – On formed sides of unit, 1/8 in., on unformed sides ofunits, 3/8 in. maximum deviation.

Part 3 - Execution

3.1 Jointing
A. Joint size: 3/8 in.

3.2 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 ¾" in. for pointing.
E. Remove excess mortar from unit faces immediately after setting.
F. Tuck point unit joints to a slight concave profile.
G. Do not field apply water repellant until repair, cleaning, inspection and acceptance is completed.

End of Section 04 72 00

END OF DIVISION 04 – MASONRY

DIVISION 5 – Metals

Section 05 12 00 – Structural Steel

Part 1 – General
1.01 Section Includes
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

Section includes:
1. Structural steel framing members
2. Baseplates, anchor bolts
3. Grouting under baseplates
4. Shop primer paint and surface preparation

1.02 Work Specified Elsewhere But Provided Under This Section

Section 04 05 00 – Masonry Mortar and Grout: Non-shrink grout
1.03 Products Furnished But Installed By Others

Section 03 30 00 – Concrete: Anchors for casting into concrete.
1.04 Related Sections
Section 05 22 00 – Steel Joists and Girders
Section 05 31 00 – Steel Deck
Section 05 50 00 – Metal Fabrications

1.05 Submittals
Shop drawings detailing fabrication of structural steel components.
1. Include details of cuts, connections, splices, cambers, holes, and other pertinent data.
2. Provide templates for anchors and bolts for installation.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

4. 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.
5. Shop drawings shall be signed and sealed by a qualified professional engineer registered in the State of Wisconsin and responsible for their preparation.

Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shop primers

1.05 References

Codes and Standards: AISC "Code of Standard Practice for Steel Buildings and Bridges"; AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" including "Commentary"; AWS "Structural Welding Code - Steel"; Comply with applicable provisions except as otherwise indicated.

1.06 Quality Assurance

Installer Qualifications: Engage an experienced installer who has completed structural steel work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the work.

1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
    a. Category: Category I, conventional steel structures.
    b. Fabricator shall be registered with and approved by authorities having jurisdiction.

Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
3. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
4. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the 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 projects with structural steel framing that are similar to that indicated for this project in material, design, and extent

Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

Pre-installation Conference: Conduct conference at project site.

1.07 Delivery, Storage, and Handling

Deliver structural steel to project site in such quantities and at such times to ensure continuity of installation.

Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.08 Field Measurements

Verify that field measurements are as shown on shop drawings.

Part 2 - Products

2.01 Materials

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)

Rolled Wide Flange (w) shapes and channel © shapes: ASTM A572, Fy=50 KSI minimum.

Cold-Formed Steel Tubing: ASTM A 500, Grade B, Fy = 46 KSI

Steel Pipe: ASTM A 53, Type E or S, Grade B, Fy = 35 KSI.

Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490, unfinished bolts and nuts, ASTM A 307, Grade A.

Welding Electrodes: Comply with AWS requirements.

Galvanized Steel: Provide galvanized steel at exposed surfaces.

2.02 Primer

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.

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.

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

Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this section and in Shop Drawings.

1. Mark and match-mark materials for field assembly.
2. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
3. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
4. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

Plane thermally cut edges to be welded.

Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.04 Shop Connections

Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.

Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

2.05 Shop Priming

Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing.
5. Galvanized surfaces.

Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 2 "Hand Tool Cleaning."
2. SSPC-SP 3 "Power Tool Cleaning."
3. SSPC-SP 7 "Brush-Off Blast Cleaning."

Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC's "Painting System Guide No. 7.00" to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.06 Source Quality Control

General Building Contractor will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel work is being fabricated or produced so required inspection and testing can be accomplished.

Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

Additional testing, at contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165
2. 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.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

Part 3 - Execution

3.01 Erection

Comply with AISC Code and Specifications and maintain work in safe and stable condition during erection. Provide temporary bracing and shoring as required; remove when final connections placed.

Set base plates 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 per Section 04 06 50 at Erector's option.

Splice members only where shown on final shop drawings.

3.02 Field Connections

Install and tighten non-high-strength bolts, except where high-strength bolts are indicated.

Install and tighten high-strength bolts according to RCSC’s “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.”

Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

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

After installation, promptly clean, prepare, and prime paint or re-prime field connections, rust spots and abraded surfaces.

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.

Clean all surfaces of dirt, mud, oil, or grease that would impair bonding of fireproofing, concrete, or paint.

3.03 Field Quality Control

Contractor will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

1. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
2. Welded Connections: Field welds will be visually inspected according to AWS D1.1. Headed shear stud welds to be tested by the "hammer test method".
    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709, performed on root pass and on finished weld.
    c. Cracks or zones of incomplete fusion or penetration will not be accepted.
    d. Ultrasonic Inspection: ASTM E 164.
    e. Radiographic Inspection: ASTM E 94.

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

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

Section Includes:

1. Open web K Series steel joists.
2. Open web LH Series steel joists.
3. Bridging and bracing.
4. Joist accessories.
5. Joist Girders.

1.02 Related Sections

Section 05 12 00 – Structural Steel
Section 05 31 00 – Steel Roof Deck
Section 05 50 00 – Metal Fabrications

1.03 References

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

Shop Drawings: Submit complete plans, details and schedules for fabrication and erection, including layout, camber, special connections, jointing and accessories.

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

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.

Erector: Company specializing in performing the work of this section with a minimum 5 years experience.

1.06 Delivery, Storage, and Handling

Deliver products to the site under the provisions of SJI requirements. Store and protect products from distortion or damage.

1.07 Field Measurements

Verify that field measurements are as shown on shop drawings.

Part 2 – Products

2.01 Materials

Steel: Comply with ASTM standards as referenced in the SJI "Specifications."

Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490, unfinished bolts and nuts, ASTM A 307, Grade A.

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.

Shop Paint: Rust inhibitive paint complying with SJI “Specifications”.

2.02 Steel Joists
Manufacture steel joists according to SJI's "Specifications," with steel-angle top- and bottom-chord members, and as follows:

Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

Furnish special bearing seats and special extended ends.

Retain one or both subparagraphs below.

2.03 Joist Accessories
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.

Bridging: Schematically indicated. Detail and fabricate according to SJI “Specifications”.

Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.04 Finish
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
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.

Provide sufficient temporary bracing to maintain framing safe, plumb, and true alignment until completion of erection and installation of permanent bridging and bracing.

Coordinate placement of anchors on masonry construction for securing bearing plates and angles.

After joist alignment and installation of framing, field weld joist seat to bearing plates.

Position and field weld joist chord extensions and wall attachments.

Do not field cut or alter structural members without approval of joist fabricator.

After erection, prime welds, abrasions, and surfaces not shop primed.

Erection: 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.

3.02 Erection Tolerances
Maximum Variation From Plumb: ¼ inch

Maximum Offset From True Alignment: ½ inch

3.03 Field Quality Control
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
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

Section Includes:
1. Steel roof deck and accessories

1.02 Related Sections
Section 05 12 00 – Structural Steel
Section 05 22 00 – Steel Joists and Girders
Section 05 50 00 – Metal Fabrications

1.03 References
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

Shop Drawings: Include layout plans, deck type, deck gauge, anchorage details, and accessories.

1.05 Delivery, Storage, and Handling

Deliver to site, store and protect decking on dry wood sleepers.

1.06 Field Measurements

Verify that field measurements are as shown on shop drawings.

Part 2 - Products

2.01 Manufacturers:

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.
5. Approved equal

2.02 Materials

Steel Roof Deck: Comply with SDI requirements for type of sections, gauge, width and depth as shown on the structural drawings.

Sheet Steel for Painted Units: ASTM A 611, Grade C or D.

Sheet Steel for Galvanized Units: ASTM A 653, Grade A.

Power Actuated Fasteners: Provide fasteners as manufactured by Hilti model X-EDN19 or X-EDNK22 nails or approved equal.

Side Lap Fasteners: Provide screws as manufactured by Hilti No. 10 self tapping screws or approved equal.

2.03 Accessories

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.

Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the decking.

2.04 Fabrication

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.

Deck Units: Comply with SDI requirements for type of sections, of metal thickness, width, and depth indicated on drawings.

2.05 Shop Priming

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.

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

Verify that field conditions are acceptable and are ready to receive work.

Beginning of installation means installer accepts existing conditions.

3.02 Installation

Erect metal decking in accordance to SDI Design Manual for Composite Decks, Form Decks, and Roof Decks.

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.

Metal Roof Deck Fasteners: Furnish and install power actuated or pneumatically driven fasteners in accordance to deck manufacturers' instructions.

Side Lap Fasteners: Secure roof deck units at side laps with metal screws installed in accordance to manufacturer's instructions.

Accessories: Place accessory units in accordance to manufacturer's recommendations unless otherwise shown.

Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.

3.03 Touch-Up Painting

After installation, promptly clean all surfaces of dirt, mud, oil or grease that would impair bonding of touch-up coating.

Repair Painting: Wire brush and clean all rust spots and abraded areas of prime painted deck and apply repair paint.

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

Field Quality Control: All deck fasteners and side lap fasteners shall be inspected by a qualified testing agency prior to installation of insulation materials.

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

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

1.02 Summary

This section includes the following:

1. Loose bearing and leveling plates.
2. Loose steel lintels.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other sections.
6. Metal floor cover plates, open grip treads, and supports.
7. Steel pipe bollards with thermoplastic bollard sleeve covers.
8. Safety net trolley track assembly
9. Bent plate jamb protectors
10. Overhead door control station
11. Pit cover plate
12. Movable pit planks
13. Open grip treads

Related sections include the following:

1. Section 03 30 00 - Cast-in-place Concrete
2. Section 04 05 13 - Masonry Mortar and Grout.
3. Section 04 20 00 – Unit Masonry
4. Section 05 12 00 - Structural Steel
5. Section 05 52 13 - Pipe and Tube Railings for pipe and tube handrails, guardrails, and railings.
6. Section 06 40 00 – Interior Architectural Woodwork: Countertop support brackets.
7. Section 11 52 00 – Audio/Visual Equipment for ceiling mounted TV/monitor.

1.03 Submittals

Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint and powder coat products.

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.

Provide templates for anchors and bolts specified for installation under other sections.

Samples for Verification: For each type and finish of extruded nosing and tread.

1.04 Quality Assurance

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.

Welding: Qualify 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.

Comply with AISC Manual, current edition.

1. Code of Standard Practice for Steel Buildings and Bridges.
2. Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.

1.05 Project Conditions

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.

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

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

Deliver fabrications, materials including accessories, anchor bolts, setting and bearing plates to the site at such intervals to ensure uninterrupted progress of the work.

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 Metals - General

Metal Surfaces, General: For metal fabrications exposed to view in the completed work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.02 Ferrous Metals

Steel Plates, Shapes, and Bars: ASTM A 36.

Steel Tubing: Cold-formed steel tubing complying with ASTM A 500, Grade B.

Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153.

Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

Steel Plates to be Bent or Formed Cold: ASTM A 283.

Hot Rolled, Rail Carbon Steel Bars and Shapes: ASTM A 499.

Cold-Finished Steel Bars: ASTM A 108.

Steel Pipe: ASTM A 53, Grade B.

2.03 Stainless Steel Wire Rope and Fittings

Manufacturers

1. Cable Connection
2. Esmet, Inc.
3. Feeney Wire Rope and Rigging
4. Johnson C. Sherman, Co., Inc.
5. Loos & Co. Inc.; Cableware Division
6. Sava Industries, Inc.
7. Seco South, Inc.
8. Approved equal

Stainless Steel Rope Cable

1. 3/8-inch diameter wire rope made from wire complying with ASTM A 492, Type 316.
2. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to a minimum breaking strength of wire rope with which they are used.

2.04 Paint

Shop Primers: Provide primers that comply with Section 09 90 00 - Painting.

Shop Primer for Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Carboline 621; Carboline Company.
   b. Aquapon Zinc-Rich Primer 97-670; PPG Industries, Inc.
   c. Tneme-Zinc 90-97; Tnemec Company, Inc.
   d. Or approved equal.

Galvanizing Repair Paint: High-zinc-dust-content paint for repairing galvanizing at welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

2.05 Powder Coating

1. Dupont Alestra®
2. Cardinal
3. Sherwin Williams
4. ISF
5. Approved equal

2.06 Fasteners

General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

Anchor Bolts: ASTM F 1554, Grade 36.

Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

Wood Screws: Flat head, carbon steel, ASME B18.6.1.

Expansion Anchors:
Manufacturers:

1. Hilti® Inc
2. Red Head®
3. Unitx®
4. Approved equal

Applications:

1. steel expansion anchors for embedment in solid or precast concrete.
2. Sleeve anchors for anchoring into concrete masonry.

Lintel Bearing Plate Anchor Bolts: Unless shown otherwise, lintel bearing plates shall be fabricated with ½" dia. x 4" long headed studs.

Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.07 Grout
Refer to Section 04 05 13 - Masonry Mortar and Grout.

2.08 Concrete Fill
Concrete Materials and Properties: Comply with requirements in Division 3 section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.09 Fabrication, General
Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

Shear and punch metals cleanly and accurately. Remove burrs.

Ease exposed edges to a radius of approximately 1/16 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

Remove sharp or rough areas on exposed traffic surfaces.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.10 Loose Bearing and Leveling Plates

Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

Galvanize plates after fabrication.

2.11 Loose Steel Lintels

Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

Weld adjoining members together to form a single unit where indicated.

Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

Galvanize loose steel lintels located in exterior walls.

2.12 Pipe Bollards

Fabricate pipe bollards from hot-dipped galvanized Schedule 80 steel pipe.

PVC bollard sleeves: ¼” thick polyethylene thermoplastic sleeves with domed head profile. Color: Caution Yellow

2.13 Open Grip Treads

Basis-of-Design Product: The design is based on the product named. Subject to compliance with the requirements, provide either the named product or a comparable product by one of the other manufacturers specified (or approved equal):

1. Open Grip Treads: GRIP-STRUT, Manufactured by GS Metals Corp., Pinckneyville, IL.
   a. Plank Style: 5-Diamond, serrated grating, 11 ¾-inch width.
   b. Plank Material: 0.080-inch Aluminum alloy.
   c. Weight: 1.59 Pounds/foot.
   d. Channel Depth: 2-inches.
   e. End Panels (both sides): Manufacturer's standard tread strap; 0.080-inch aluminum. U-shaped strap with slot and hole configuration, spot fillet welded to strut.
   f. Accessories: 0.25 inch aluminum plates as indicated on the drawings.
2. McNichols Co.
3. REDD Team Mfg, Inc.
4. Or approved equal

2.14 Manifold Access Panels

Material: 3/8" thick galvanized diamond plate steel

Access panels shall be 20" wide x 30" long. Fabricate with countersunk fasteners at corners for easy removal.

Prime and paint light grey to match surrounding high traffic coating system.

2.15 Miscellaneous Framing and Supports

General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the work.

General: Provide steel framing and supports indicated and as necessary to complete the work.

Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

Galvanize miscellaneous framing and supports where indicated.

2.16 Safety Net Trolley Track Assembly

Where indicated on the drawings, provide steel tube track consisting of light-duty 1-5/8-inch O.D. steel enclosed track system 120 lb. load rated tube track manual trolley.

Manufacturer:

1. Martin Gregory Conveyor & Engineering Co.; Phone: (812) 923-9814.
2. Duratrack, Inc., Elk Grove Village, IL.
3. Unistrut Systems
4. Approved equal

2.17 Finishes, General

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Finish metal fabrications after assembly.

2.18 Steel and Iron Finishes

Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

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 metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

Stripe paint corners, crevices, bolts, welds, and sharp edges.

Powder Coating: Shop apply polyester powder coating, minimum 4 mil film thickness.

Part 3 - Execution

3.01 Installation, General

Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 Setting Bearing and Leveling Plates

Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.03 Installing Miscellaneous Framing and Supports

General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

Anchor supports for operable partitions securely to and rigidly brace from building structure.

Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.

Do not grout baseplates of columns supporting steel girders until girders are installed and leveled.

Guardrail at stairs to scale tunnel

1. Verify that grouted CMU bearing surfaces are level and ready to receive guardrail posts.
2. Anchor guardrail posts with expansion anchors.

3.04 Adjusting and Cleaning

Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 section "Painting."

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

End of Section 05 50 00

Section 05 52 13 – Pipe and Tube Railings

Part 1 – General

1.01 Related Documents

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

1.02 Summary

This section includes the following:

1. Steel pipe and tube handrails, railings, and guardrails.

Related sections include the following:

1. Section 05 50 00 - Metal Fabrications
2. Section 32 31 19 - Decorative Metal Gates

1.03 Performance Requirements

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.

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

Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other work.

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 the following.

1. Handrails, guardrails, and railings.

1.05 Quality Assurance

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.

Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer.

1.06 Storage

Store handrails and railings in a dry, well-ventilated, weathertight place.

1.07 Project Conditions

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.

1.08 Coordination
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.

1.09 Scheduling
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
General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

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: 0.145”
   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).

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
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.

Fasteners for Anchoring Handrails and Railings to Other Construction: 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 Paint
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.

2.04 Fabrication

General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less that that required to support structural loads.

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.

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.

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.

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.

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.

Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

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.

Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

Close exposed ends of handrail and railing members with prefabricated end fittings.

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 ¼ inch (6 mm) or less.

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.

Cut, reinforce, drill, and top components as required to receive stainless steel cable system.

2.05 Finishes, General

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.

2.06 Steel Finishes

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.

For non-galvanized steel handrails and railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

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."

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.

Stripe paint edges, corners, crevices, bolts, and welds.

Part 3 – Execution

3.01 Examination

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

Fit exposed connections together to form tight, hairline joints.

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 ¼ inch in 12 feet (5 mm in 3 m).

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.

Fastening to In-Place Construction: Use anchorage devices and fasteners here necessary for securing handrails and railings and for properly transferring loads to inplace construction.

3.03 Railing Connections

Welded Connections: use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections tin “Fabrication” Article whether welding is performed in the shop or in the field.

3.04 Anchoring Posts

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:

For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.05 Anchoring Railing Ends

Anchor posts to metal surfaces with oval flanges bolted to metal surfaces.

1. Weld flanges to railing ends.

3.06 Attaching Handrails To Walls

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.

Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.07 Cleaning
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
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.

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

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
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.

Work includes:
1. Treated wood blocking at roof edge
2. Treated wood blocking at translucent panel sill.
3. Wood blocking, furring
4. Fasteners, anchors

1.02 Related Sections
Section 06 20 00 – Finish Carpentry
Section 06 40 00 – Interior Architectural Woodwork

1.03 Submittals
Product data for engineered wood products, sheathing, framing connectors, and construction adhesives.

Part 2 - Products

2.01 Framing Materials

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.

Provide seasoned lumber with 19 percent moisture content at time of dressing and shipment, for sizes 2 inches or less in thickness.

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.

Provide all miscellaneous wood blocking not indicated as provided by other trades/sections.

Preservative pressure treat lumber and plywood with water-borne preservatives to comply with AWPA 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.
2. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.05 Fasteners:

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

Install rough carpentry work to comply with N.F.P.A. "Manual of House Framing, Form E30," "APA Design/Construction Guide - Residential and 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.

Set rough carpentry to required levels and lines, with members plumb and true and cut to fit.

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.

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 16 43 – Exterior Gypsum Wall Sheathing

Part 1 – General

1.01 Summary of Work:

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

Work includes:

Furnish and install glass mat gypsum sheathing board wall sheathing.

1.02 Related Work Specified Elsewhere:

Section 07 27 26 – Fluid Applied Membrane Air Barrier Membrane
Section 09 22 16 – Non-load Bearing Metal Wall Framing

1.03 Submittals

Product Data: Submit manufacturer’s descriptive literature indicating material composition, thickness, sizes and fire resistance.

Certificates: Submit manufacturer’s written certification that product meets specified requirements.

1.04 Quality Assurance

Fire-resistance ratings: Where applicable, provide materials and construction that are identical to those of assemblies whose fire-resistance ratings are indicated.

1.05 Delivery, Storage and Handling

Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible.

Storage and handling: Store level and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

1.06 Limitations

Do not use sheathing as a base for nailing or mechanical fastening. Fasteners should be flush to the face of the board, not countersunk.

The use of forced air heaters creates volumes of water vapor which, when not properly vented, can condense on building materials. The use of these type heaters and any resulting damage is not the responsibility of the sheathing manufacturer. Consult heater manufacturer for proper use and ventilation. Avoid any condition that will create moisture in the air and condensation on the exterior walls during periods when the exterior temperature is lower than the interior.

Do not laminate sheathing to masonry surfaces; use furring strips or framing spaced at manufacturer's specifications.

Do not apply sheathing below grade.

For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed per system specifications. Openings and penetrations must be properly flashed and sealed. Failure to do so will void the warranty.

1.07 Warranty

Materials Warranty: Provide sheathing manufacturer's standard warranty covering sheathing materials for five years commencing on date of purchase.

Weathering Warranty: Provide sheathing manufacturer's standard warranty covering in-place exposure damage to sheathing for six months commencing on date of purchase by contractor.

Part 2 - Products

2.01 Manufacturers

1. Georgia-Pacific Co. “Dens-Glass Gold”
2. US Gypsum “Aqua-Tough”
3. CertainTeed “GlasRoc”
4. Approved equal.

2.02 Materials

Size: 4’ x 8’, 9’ or 10’ (contractor’s option).

Thickness: 5/8 inch

Composition: Gypsum sheathing manufactured in accordance to ASTM C 1177 with glass mats both sides and long edges, water-resistant treated core.

Fire resistance:

1. Noncombustible when tested in accordance to ASTM E 136.
2. Flame spread 0, smoke developed 0, when tested in accordance to ASTM E 84.

2.03 Accessories

Screws, metal framing:

1. Type S-12, bugle head, self-tapping, rust-resistant, fine thread for heavy-steel gauge (12 to 22).
2. Type S, bugle head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

Sealants, Caulk and Tape:

1. Dow Corning 795 or equivalent; Pecora 895 or equivalent.
2. Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent; Pecora AC-20 acrylic latex sealant; GE Silicone Silpruf Sealant; Tremco Dymonic, or equivalent.
3. 2" wide 10 x 10 glass mesh Quick Tape or equivalent

Part 3 - Execution

3.01 Preparation

Examine subframing; verify that surface of framing and furring members are ready to receive sheathing.

3.02 Sheathing

Install sheathing where indicated on drawings in accordance to manufacturer’s instructions and applicable instructions in GA-253 and ASTM C 1280.

Use maximum lengths possible to minimize number of joints.

Metal Framing: Attach sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.

Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.

Locate fasteners minimum 3/8" from edges and ends of sheathing panels.

Finishing:

1. Seal fasteners using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent.
2. Finish joints using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent. Reinforce with 2" wide 10 x 10 glass mesh Quick Tape or equivalent.

End of Section 06 16 43

Section 06 20 00 – Finish Carpentry

Part 1 - General

1.01 Work Included

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

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

Section 06 10 00 – Rough Carpentry
Section 06 40 00 – Interior Architectural Woodwork
Section 08 11 13 – Steel Doors and Frames
Section 08 71 00 – Finish Hardware
Section 10 28 00 – Toilet and Bath Accessories

Part 2 - Products

2.01 Materials

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.

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

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

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

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

Section 06 10 00 – Rough Carpentry
Section 06 20 00 – Finished Carpentry

1.03 References

ANSI / BHMA A156.9 – Cabinet Hardware
AWI – Quality Standards

1.04 Submittals

Shop Drawings: Submit shop drawings for each item of architectural woodwork.

Hardwood Wainscoting: Submit complete shop drawings including elevations of all walls scheduled to receive wood wainscoting. Elevations shall indicate panel widths and layout

spacings using the multiple panel widths available from the manufacturer and specified herein.

Samples: Submit finished samples of each wood species and cut indicated for transparent finish; of each material indicated for opaque finish; of each color, pattern, and finish of plastic laminate; and of each type of cabinet hardware.

Hardwood Wainscoting: Submit component samples for on-site mock-up section by contractor. Samples shall be of wood species and veneer specified under this specification section.

1.05 Qualifications

Manufacturer: Company specializing in the manufacturing the products specified in this section with a minimum of five years' of experience.

1.06 Field Measurements

The cabinet manufacturer shall be responsible for confirming all field measurements prior to fabrication.

Part 2 - Products

2.01 Plastic Laminate Materials

Manufacturers

1. The color selections listed in the Color Schedule is based on plasticlaminates manufactured by Formica. The following manufacturer's will be accepted subject to approval by the architect.
    a. Wilsonart
    b. Nevamar
    c. Pionite

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.

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 <u>not</u> 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 in accordance to Paragraph 2.01.C, 6., "Edging Locations":
    a. PVC, .020". Solid, high impact, purified, color-through, acid resistant PVC edging.
    b. 3mm thick PVC. Solid, high impact, purified, color-through, 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 and 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

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.

Pulls:

1. 4” Wire design: Stanley #4484.
2. Provide two at drawers over 29".
3. Finish to be available in chrome powder finish, black, beige, dove gray, or white epoxy coated.

Drawer Slides:

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.

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.

Adjustable Shelf Supports: To be twin pin design with anti tip-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.

Locks: Hinged doors and drawers to be provided with disc tumbler lock keyed alike and master keyed. Dull chrome finish.

Manufacturers

1. National Cabinet Lock, Atlanta, GA., #M4-7054.
2. Timberline
3. Best
4. Approved equal.

2.03 Countertop Support Brackets

Countertop support brackets shall be shop fabricated from ¼" 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.

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

Manufacturers:

1. Meganite™ Acrylic Solid Surface
2. Avonite
3. Corian
4. Approved equal.

Colors: Refer to Color Schedule.

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 manufacturers standard oval shaped integral bowl.
    a. Color: Selected from manufacturer's standard range of colors.
    b. Inside Dimensions: 18-1/2" x 12-1/2" x 5-1/8" deep

Window Stools: Fabricate from ½-inch thick solid surface to stool depth indicated on the plan with a 1-1/4-inch dropped edge and 1 inch "ear" extensions at window jamb openings.

2.05 Fabrication

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 1¼" 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 3¾" 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 ¼" 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 ½" 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 ¼" thick, smooth both faces. Secured in cabinet with molded plastic clips.
    i. Pressure Fused laminate ¾" thickness. Secured in cabinet with molded plastic clips or dowels.
    j. Door/Drawer Front Rail: Provide minimum ¾" x 6" x full width cabinet body rails immediately behind all door/drawer and multiple drawer horizontal joints.

Plastic Laminate Countertops
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. Provide field glued splines at joints. No joints closer than 24" either side of sink cutout.

2.06 Field Finishes for Architectural Woodwork:
Finishing by Section 09 90 00.

Part 3 - Execution
3.01 Examination
Verify adequacy of backing and support framing.

3.02 Installation
Set and secure casework in place; rigid, plumb, and level.

Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

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

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

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.
2. Surface preparation.
3. Application of rolled, self-adhering waterproofing membrane system.
4. Rigid insulation protection board.

1.02 Related Sections

Section 03 30 00 - Cast-in-Place Concrete.
Section 07 21 13 – Board Insulation: Protection board

1.03 References

ASTM D 146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

ASTM D 412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

ASTM D 570-98 - Standard Test Method for Water Absorption of Plastics.

ASTM E 96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

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
Submit manufacturer's product data and application instructions.

1.05 Delivery, Storage, and Handling
Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

Store materials in a clean dry area in accordance to manufacturer's instructions.

Store adhesives and primers at temperatures of 40oF (5oC) and above to facilitate handling.

Store membrane cartons on pallets.

Do not store at temperatures above 90^{o}F (32^{o}C) for extended periods.

Keep away from sparks and flames.

Completely cover when stored outside. Protect from rain.

Protect materials during handling and application to prevent damage or contamination.

1.06 Environmental Requirements
Product not intended for uses subject to abuse or permanent exposure to the elements.

Protect rolls from direct sunlight until ready for use.

Do not apply membrane when air or surface temperatures are below 40^{o}F (4^{o}C).

Do not apply to frozen concrete.

Part 2 - Products
2.01 Manufacturers
Foundation Wall Membrane
Carlisle Coatings and Waterproofing; MiraDRI 860/861
Grace Construction Products; Bituthene 3000
W. R. Meadows, Inc., Hampshire, IL: Mel-Rol
Approved equal

Underslab Membrane

Grace 300 Preprufe
CETCO® 'Coreflex 30'
Approved equal

2.02 Materials – Foundation Wall Waterproofing Membrane

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 -25oF (-32oC): Unaffected.
   f. Water Vapor Permeance, ASTM E 96, Method B: 5.72 x 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 (73.1m) 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

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 231 feet 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 B.

2.04 Accessories

Primer:

1. Temperatures Above 40^{o}F (4^{o}C): Manufacturer's recommended water base primer
2. Temperatures Above 20^{o}F (-7^{o}C): Manufacturer's recommended VOC Compliant Solvent Base Primer or Standard Solvent Base Primer.

Flashing and Fillets: Manufacturer's standard liquid membrane.

Pointing Mastic

Corner Tape: Detail Strip.

Waterproofing Protection Course: Refer to Section 07 21 13–Board Insulation

Part 3 - Execution

3.01 Examination

Examine surfaces to receive membrane. Notify the architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 Surface Preparation

Protect adjacent surfaces not designated to receive waterproofing.

Clean and prepare surfaces to receive waterproofing in accordance to manufacturer's instructions.

Do not apply waterproofing to surfaces unacceptable to manufacturer.

Concrete surfaces must be clean, smooth and free of standing water.

Patch all holes and voids and smooth out any surface misalignments.

3.03 Application - Vertical Surfaces

Apply waterproofing membrane system in accordance to manufacturer's instructions.

Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.

Prime surfaces to be covered in one working day with applicable primer. Re-prime uncovered surfaces next day.

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.

Perform flood testing of horizontal applications, as required. Mark leaks and repair when membrane dries.

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

Strictly comply with installation instructions in manufacturer's published literature, including but not limited to, the following:

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.

1. Leave the plastic release liner in position until overlap procedure is completed.
2. 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.
3. 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.
4. Completely remove the plastic liner to expose the protective coating. Any initial tack will quickly disappear.

3.05 Protection Board Installation

Prepare and clean waterproof membrane surface.

Apply rigid insulation boards with long edge horizontally.

Secure boards to foundation wall with adhesive prior to backfilling operations. Butt all edges tightly.

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:

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

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

Section 03 30 00 – Cast-In-Place Concrete
Section 04 20 00 – Unit Masonry : Cavity wall insulation
Section 07 13 53 – Elastomeric Sheet Waterproofing: Protection board

1.03 References

ASTM C578-92, standard specification for rigid, cellular polystyrene thermal insulation.

Part 2 - Materials

2.01 Manufacturers

1. Dow 'Styrofoam'
2. Owens Corning 'Foamular®
3. Diversifoam Products 'Certifoam'
4. Approved equal

2.02 Materials

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
   c. Horizontal Surface Protection Board: 25
   d. Underslab Insulation @ Operations Building: 40 psi
   e. Underslab Insulation @ Inspection Building: 60 psi
   f. Roof Overhang Soffit: 25 psi

Adhesive:

Adhere insulation to concrete foundation walls adhesive as recommended by board manufacturer.

Part 3 - Execution

3.01 Preparation

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.

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.

If not indicated, extend insulation a minimum of 48 inches below exterior grade line.

3.02 Installation

Underslab Insulation

Butt end joints and edges tight to adjacent board.

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

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

Work includes:

1. Fiberglass batt wall insulation.
2. Vapor retarder membrane barrier

1.02 Related Sections

Section 09 22 16 – Metal Studs

1.03 References

ASTM C665 – Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

FS HH-I-521 – Insulation Blankets, Thermal

1.04 Performance

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.

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

Product Information: Submit product data for each form and type of insulation indicated.

Part 2 – Products

2.01 Manufacturers

Fiberglass Batt Insulation

1. Johns Manville
2. Knauf
3. Owens Corning
4. CertainTeed
5. Approved equal

Reinforced-Polyethylene Vapor Retarders

1. Ravin Industries, Inc., Sioux Falls, SD; DURA-SKRIM 6WW
2. Reef Industries, Inc., Houston, TX: Griffolyn® Type-65
3. Approved equal

2.02 Materials

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.

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

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 contractor prior to proceeding with installation of batt insulation.

3.02 Installation

Insulation

1. Install insulation in accordance 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.

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 (Core Fill)

Part 1 – General

1.01 Scope of Work

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

Work includes;
Foamed-in-place masonry insulation

1.02 Related Sections

1.03 Submittals
Products and technical presentation as provided by the manufacturer.

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.

Material Safety Data Sheet; Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.04 Quality Assurance
Manufacturing Standards: Provide Insulation produced by a single and approved manufacturer.

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.

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 Manufacturer

1. Tailored Chemical Products, Hickory, N.C.: “Core-Fill 500”
2. Thermco™, Thermal Cororation of America, Mt. Pleasant, IA
3. Core-Foam, Inc., Knoxville, TN
4. Approved equal

2.02 Insulating Materials
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-inch and 12-inch 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-inch wall assembly (ASTM E 90-90).

Part 3 – Execution

3.01 Preparation

Verify that work by other trades to be embedded in CMU walls has been completed and ready to be encapsulated with foam.

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

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.

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

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

Work includes:

The work shall consist of covering all areas shown on the drawings with nailbase roof insulation.

1.02 Related Work

Section 05 31 00 – Steel Decking
Section 07 41 00 - Standing Seam Metal Roof System

1.03 Performance Requirements

Performance requirements:

1. The wood spacer blocks within the ventilation space shall not exceed 5% of the panel area and will allow air flow both up the slope and horizontally. The air space shall provide a minimum of 9 Sq. In. of Net Free Area per linear foot of insulation.
2. The spacer blocks within the ventilated area and the sheathing panels below the ventilated area, shall be sufficient to avoid compression of the isocyanurate insulation under a compressive load of 200 p.s.f.
3. The isocyanurate foam insulation shall have a density averaging at least 2 p.c.f. and a compression resistance of 20 p.s.i.
4. The isocyanurate foam shall have a Flame Spread Rating of 25 or less.

1.04 Quality Assurance

Each bundle of 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.

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.

1.05 References

Foam insulation shall comply with FMRC Std. 4450/4470.

1.06 Submittals

Copies of the manufacturer's insulation catalog and installation instructions shall be submitted along with a sample of the product.

1.07 Delivery Storage and Handling

The insulation shall be protected in transit by stretch wrapping and by truck tarps.

Material stored at the jobsite shall be covered with tarps.

1.08 Project/Site Conditions

If material is stored at the jobsite, a reasonable level, drained storage area shall be provided.

1.09 Sequencing/Scheduling

Erection of the insulation shall be coordinated with the roofing subcontractor so that the roofing is applied as soon as possible after insulation is in place.

Part 2 – Products

2.01 Acceptable Manufacturers

1. Atlas Roofing Corp., Atlanta, GA
2. Cornell Corporation, Cornell, WI ; ThermaCal 1 non-vented
3. Johns Manville, Denver, CO
4. Approved equal

2.02 Materials

Description of System :

1. The roof insulation shall be a factory assembled panel consisting of a 5/8" oriented strand board top surface, and a layer of felt on the bottom. (Note: Spacer blocks cut from foam insulation will not be acceptable.)
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. Foam insulation edges shall be tongue and groove.
3. Panels shall be a nominal 48" x 96" and shall be accurately trimmed to length and width after assembly. Edges shall be rabbetted to allow clearance between the wood on adjoining panels.

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

The structural roof deck shall be smooth and level and free of water or debris before the insulation is installed.

3.02 Installation

Installation shall follow the manufacturer's written installation instructions shipped with the material. Protect insulation 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

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

This section specifies the following:

Water-resistant fluid-applied air and vapor barrier in exterior masonry wall assemblies.

Spray-applied polyurethane foam.

1.02 Related Work By Others
Section 04 20 00 – Unit Masonry
Section 06 16 43 – Gypsum Sheathing

1.03 Performance Requirements
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) (0.02 L/m^2 @ 75 Pa.) when tested according to ASTM E 2178.

1.04 Submittals
Submittals: Submit in accordance to Division 1 – General Requirements.

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.

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.

Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.

1.05 Quality Assurance
Air Barrier Installer Qualifications: Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified in accordance to the ABAA Quality Assurance Program.

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.

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).

VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.

1.06 Delivery, Storage and Handling

Deliver materials to project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

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.

Handle materials in accordance to manufacturer's recommendations.

1.07 Project Conditions

Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer.

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 in accordance to manufacturer's recommendations.

1.08 Warranty

Material Warranty: Provide manufacturer's standard product warranty, for a minimum 3 years from date of Substantial Completion.

Part 2 – Products

2.01 Materials – General

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.

2.02 Manufacturers – Fluid-Applied Air and Vapor Barrier

Subject to compliance with requirements, provide one of the following or approved equal:

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 Through-Wall Flashing.
    f. Mastics, Adhesives and Tapes: Pointing Mastic.
    g. Website: www.wrmeadows.com.

2.03 Manufacturers - Spray Polyurethane Foam Insulation

1. Commercial Thermal Solutions
2. BASF
3. CertainTeed Saint-Gobain ‘CertaSpray®Closed Cell Foam
4. Icynene Inc. MDC 200 (V3)
5. Approved equal

2.04 Auxiliary Materials

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

Examine substrates, areas, and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.

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.

Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.

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

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.

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.

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

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 in accordance 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:

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.

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.

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.

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.

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.

Overlap horizontally adjacent pieces of transition strips a minimum of 2 inch (5mm), unless greater overlap is recommended by manufacturer. Roll seams with roller.

Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance to manufacturer's recommendations.

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 in accordance to the manufacturer's recommendations.

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.

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.

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

Apply spray polyurethane where indicated on the drawings as a component of the building air barrier system. Minimum thickness of cured foam shall be 1-1/2 inches.

3.05 Field Quality Control

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

Protect air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.

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

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

Work Includes:

1. Standing seam metal roof panels.
2. Fasteners, clips, furring channels, flashings, and miscellaneous accessories.
3. Gutters and 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

1.02 Related Work

Section 07 22 00 – Nail Base Roof Insulation
Section 07 60 00 – Flashing and Sheet Metal
Section 07 71 23 – Manufactured Gutters and Downspouts
Division 22 – Plumbing: Roof vent penetrations
Division 23 – HVAC: Roof top mounted equipment and duct penetrations.

1.03 Submittals

Product Data: Submit manufacturer's specifications and installation instructions.

Shop Drawings: Submit shop drawings consisting of catalog outs, design and erection drawings, finish specification, and other data necessary to clearly describe design materials, sizes, layouts, construction details, fasteners, and erection.

Samples

Roof Panel: Full panel width, 12 inches long including mechanically seamed standing seam.

Test Reports: Submit test reports prepared by (UL) Underwriters Laboratories, Inc. indicating wind uplift rating of proposed roof system.

1.04 Quality Assurance

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.

Applicator Qualifications: Five years minimum experience in application of standing seam roofs.

1.05 Performance Requirements

No water penetration of the panel assembly shall be permitted when tested at 20 psf pressure for 15 minutes in accordance to ASTM Test Procedure E331.

Deflection shall be limited to L/240 for positive loading.

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

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

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 in accordance to standard procedures specified in ASTM D 659-74.
3. Will not peel, crack, chip or delaminate.

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

Metal Roof Panels

1. Peterson Aluminum (PAC-CLAD): Tite-Loc
2. Firestone Una-Clad 'UC-3'
3. Berridge Manufacturing Co.; Houston, TX
4. AEP Span, Dallas, TX;
5. Approved equal

2.02 Materials

Roof Panels:

1. General: Metal roof panel system shall consist of a mechanically field-seamed to a 90 degree lock-formed with 2" high field seamed standing seams.
2. Steel: AISI G90 hot dipped galvanized, extra-smooth primed and finished on one side.

3. 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.
4. Center to center panel width: 18 inches
5. Individual panels shall be removable for replacement of damaged material without disturbing adjacent panels.
6. Fabricate panels in full length with no end laps.
7. Provide factory eave notching where conditions require fascia returns.
8. Flashing and trim shall be of the same material, gauge, finish, and color as the panels.
9. Color: Match Peterson Aluminum 'Colonial Red'

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.

Self-Adhering Sheet Membrane Roofing Underlayment:

1. Manufacturers
   a. Carlisle Coatings and Waterproofing: CCW WIP 403HR
   b. Grace Co. Ice and 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 silconized release sheet. Roofing underlayment shall meet or exceed UL-790 Tests for Fire Resistance of Roof Coating Materials Class A and C.

Gutters: Refer to Section 07 71 12 – Manufactured Gutters and Downspouts

Metal Flashing Accessories: Refer to Section 07 60 00 – Flashing and Sheet Metal.

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.

Part 3 - Execution

3.01 Inspection

The installer shall examine the building to verify that the structure is ready for roofing installation.

All structural supports shall be in place and all sag rods, diagonal bracing and connections shall be tightened before work can proceed.

Field check dimensions and check support alignment with a taut string or wire; support misalignment will cause panel “oil-canning”.

Do not proceed until unsatisfactory conditions are corrected.

3.02 Installation

Self-Adhering Ice and 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.

Standing Seam Metal Roofing:

1. Install metal panel system in accordance to approved erection drawings and instructions.
2. All attachments shall allow for thermal expansion and contraction of the roofing panels.
3. 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.

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.

End of Section 07 41 00

Section 07 42 13 – Metal Wall Panels

Part 1 – General

1.01 Section Includes

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

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

B. Includes:

1. Foamed insulation core horizontal metal wall panel assembly with integral reveals.
2. Related metal trim and accessories.

1.2 Related Work

Section 07 60 00 – Flashing and Sheet Metal
Section 07 92 00 – Joint Sealants

1.3 References

American Architectural Manufacturer's Association (AAMA):

1. AAMA 605.2 – Voluntary Specification for High Performance Organic Coatings for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
2. AAMA 508-05 – Test method for Pressure Equalized Rain Screen Wall Systems.

American Society of Civil Engineers (ASCE):

1. ASCE- 7 Minimum Design Loads for Buildings and Other Structures

ASTM International (ASTM):

1. ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc iron Alloy-Coated (Galvannealed) by the Hot-dip Process.
2. ASTM C 920 – Specification for Elastometric Joint Sealants.

3. ASTM E 84 – Test Methods for Surface Burning Characteristics of Building Materials.
4. ASTM E 96 – Test Methods for Water Vapor Transmission of Materials.
5. ASTM # 119 – Test Methods for Fire Tests of Building Construction and Materials.

Underwriters Laboratories, Inc. (UL):

1. UL263 – Fire Resistance Tests of Building Construction and Materials.
2. UL 723 – Test for Surface burning Characteristics of building materials
3. Fire Resistance Directory
4. UL 1715 Room Corner Test

1.4 Performance Requirements

A. Air Infiltration: Maximum 0.06 cfm/sf (0.3 L/s per sq.m) per ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sf (300 Pa) using minimum 10 feet by 10 feet (3050mm by 3050) test panel that includes horizontal and vertical joints.

B. Water Penetration – Dynamic Testing: No uncontrolled water penetration per AAMA 501.1 at a minimum pressure differential of 15 lb/sf (.72 kPa) using a minimum 10 feet by 10 feet (3050mm by 3050mm) test panel.

C. Horizontal Panel Joint Performance – Static test per ASTM E331 with horizontal seals removed – I inch (25 mm) in 10 feet (3050 mm) lengths to simulate seal defects. No uncontrolled water penetration permitted at a pressure of 15 lb/sf (.90 kPa).

D. Pressure Equalization of Horizontal Joinery – Passes the Criteria for a Pressure Equalized Horizontal Joint in accordance to AAMA 508-05 a test method for Pressure Equalized Rain Screen Wall Systems.

E. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated per ASTM E-72.

1. Wind Loads: Determine loads based on uniform pressure indicated on Drawings or calculated per IBC 2003 whichever is more stringent.
2. Deflection Limits: Withstand test pressures of inward and outward wind-load design pressures with maximum deflection of L/180 of the span with no failure.
3. Secondary Framing: Design secondary framing system according to AISI ‘Standard for Cold-Formed Steel Framing – General Provisions.’ Provide bearing surface for metal wall panels at the following locations:
    a. Horizontal Panel System: At vertical joints 4 inches minimum (102 mm).
    b. Vertical Panel System: At horizontal stack joints 4 inches minimum (102mm).

1.5 Submittals

A. Product Data: Manufacturer's data sheets for metal wall panels and accessories.

B. Product Test Reports: indicating compliance of products with requirements, from a qualified independent testing agency.

1.6 WARRANTY

A. Standard Warranty – The manufacturer shall warrant for a period of two years that the wall system materials will be free from defects. The wall systems contractor shall warrant for a period of two years that the installation workmanship will be free from defects.

B. Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panels that evidence deterioration of fluropolymer finish within 20 years from date of Substantial Completion.

Part 2 - Products

2.1 Manufacturers

A. Centria Architectural Systems

B. Metl-Span

C. Kingspan Benchmark

D. Approved equal

2.2 Foamed Insulation Core Metal Wall Panels

A. Panel System Product

1. CENTRIA, Forma Wall Graphix Series 2 (2 inches (51mm) thick panel).
2. Factory-foamed horizontal and vertical wall panel system consisting of an exterior metal sheet with interior metal liner panel, bonded to factory foamed-in-place core in thermally-separated profile, with factory sealed tongue-and-groove and rainscreen-design pressure –equalized-chamber horizontal joint, and attached to supports using concealed fasteners.
3. Foamed Insulation Core: urethane or isocyanurate, density 2.7 lb/cu. Ft. min (43.4 kg/cu.m), min compressive strength 20 lb/sq.in. (137.9 kPa), and containing no CFC or HCFC compounds.
4. Thermal performance of the wall panels shall be based on tests in accordance to ASTM C236 corrected to 15 mph outside and still air inside. Tests shall include side-joint, standard fastening and integral reveals or profiling. Values are based upon a full panel thickness. Where reveals exceed the standard or multiple segmented joints are required, the manufacturer shall provide similar testing to document any adjustments required to the standard conditions.
   a. R value for 2" flat panel shall be 14.
5. Panel Sealant/Vapor Seal: Factory-applied non-curing butyl.

B. Steel Sheet Exterior and Interior Facing: Contractor engineered panel meeting requirements indicated in Performance Requirements Article.

C. Face sheet shall be 22 gage (0.70 mm) or 20 gage (0.91 mm):
   1. Surface: Embossed.

D. Liner Sheet: 26 gage, 0.0179 inch (0.45 mm) (G-90 coating, embossed, planked with .2 mil primer and 0.6 mil acrylic finish.

E. Liner Sheet: 22 gage, 0.0299 inch (0.75 mm) G-90 coating, embossed, planked with .2 mil primer and 0.6 mil acrylic finish.

F. Panel System Design:
   1. Panel Joinery:
      a. Horizontal Panels: Rain Screen design with equalized pressure chamber.
   2. Panel Width and Length: Refer to Contract drawings.
   3. Horizontal panel reveal depth to be a minimum of 1-3/16 inches (30 mm) for 2" panel.
   4. Exterior face to have intermediate segmented joints that are 5/8" wide and ¾" deep.
   5. The inside of the segmented joint to be one of the following:
      a. Black, fire-retardant neoprene gasket-factory applied.
      b. Painted aluminum strip, color that contrasts from the panel TBD-factory applied and meets C2C certification.
      c. Metal in the same color as the face panel and meets C2C certification.
   6. Segmented joints are located as shown on the drawings.
   7. Option to the segmented joint faced panel is to produce individual panels that create the same appearance in width and length as shown on the drawings.

2.3 Materials

A. Metallic-Coated Steel Face Sheet, Coil Coated, per ASTM A 755/A 755M:
   1. Zinc-coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90, structural quality. NOTE-Galvalume is not an acceptable substrate for architectural metal wall panels.

2.4 Finish

A. Standard Fluoropolymer Two-Coat system consists of 0.2 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat.

B. Color: Custom color to match standing seam metal roofing.

2.5 Accessories

A. Metal Wall Panel Accessories

1. Provide complete metal wall panel assembly incorporating trim, copings, fascia, parapet caps, soffits, sills, inside and outside corners, jambs and miscellaneous flashings. Include required fasteners, gaskets, closure strips and sealants.
2. All exposed trim and extrusions shall be finished to match panel.

2.6 Miscellaneous Materials

A. Sealant: Synthetic non-skinning butyl rubber sealant, as recommended by panel manufacturer, for metal wall panel assemblies to remain watertight.

B. Fasteners: Self-tapping screws, bolts, nuts and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal wall panels by means factory-applied coating.

Part 3 - Execution

3.1 Installation

A. Install miscellaneous framing and anchorage according to ASTM C754, metal wall panel manufacturer's written recommendations, and approved shop drawings.

B. General: Install metal wall panels in orientation, sizes and locations indicated. Anchor metal wall panels and other components securely in place. Provide for thermal and structural movement.
1. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as approved by manufacturer.
2. Field cutting of metal wall panels is not permitted.
3. Fasten metal wall panels to supports with concealed clips at each joint or locations as shown on the shop drawings, with self tapping fasteners as recommended by the manufacturer.
4. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

C. Fasteners for Steel Wall Panels
1. Exterior: Stainless-steel
2. Interior: Carbon steel

D. Metal Protection: Provide metal wall panel manufacturer's recommended permanent separation material where dissimilar metals will contact each other or corrosive substrates.

E. Joint Sealers: Install gaskets, joint fillers and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies.

1. Seal metal wall panel accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

2. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.2 Accessory Installation

A. General: Install metal wall panel accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install related flashings and sheet metal trim per requirements of Division 07 Section 'Sheet Metal Flashing and Trim'.
   2. Install components required for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips and similar items.
   3. Comply with performance requirements and manufacturer's written installation instructions.
   4. Provide concealed fasteners except where noted on approved shop drawings.
   5. Set units true to line and level as indicated. Install work with laps, joints and seams that will be permanently watertight and weather resistant.

3.3 Cleaning and Protection

A. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.

B. Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair.

End of Section 07 42 13

Section 07 46 00 – Prefinished Metal Soffit Panels

Part 1 - General

1.1 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

1.2 Related Sections

A. Section 07 60 00 – Flashing and Sheet Metal

B. Section 09 22 16 – Non-load Bearing Metal Wall Framing

1.3 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.

1.4 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

2.1 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'.
3. McElroy Metal Inc.; Bossier City, LA: Marquee Series
4. Approved equal

2.2 Materials

A. Soffit Panels

1. Panel Profile: Non-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. 'Z'-Furring: Galvanized 25 gauge x custom depth "Z" profile with 1-1/4"wide flange for placement against the substrate.

2.3 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

3.1 Installation

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 in accordance 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.

3.2 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

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

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. Miscellaneous sheet metal accessories.

1.02 Related Sections

Section 04 20 00 – Unit Masonry: Metal drip edge at through-wall flashing
Section 07 41 00 – Standing Seam Metal Roofing
Section 07 63 00 – Vented Roof Edge Fascia
Section 07 71 12 – Gutters and Downspouts
Section 08 84 00 – Insulated Translucent Panels: Sill Flashing

1.03 Submittals

Shop drawings showing layout, profiles, method of joining, anchorage details, etc.

Samples for Verification: For each type of exposed flashing required indicated below:

1. Stainless steel drip edge for embedment if masonry walls.
2. Stainless steel receiver and counterflashing at embedded metal roof flashing.
3. Prefinished galvanized steel sill flashing at windows and translucent panels.
4. Prefinished galvanized steel column enclosure cladding.
5. Roof penetration flashings

1.04 Performance

Performance: Watertight and weatherproof performance of flashing and sheet metal work is required.

1.05 Warranty

Provide manufacturers 20 year written guarantee covering film integrity, fading, chalking.

Part 2 – Products

2.01 Materials

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. Vincent Metals "Colorklad"
   d. AEP Span
   e. MetalEra, Inc.
   f. Approved equal

Aluminum Sheet: ASTM B 209, alloy 3003-H14, 0.032 inch (20 ga.).

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.

Stainless Steel: ASTM A 240/A 240M, Type 304

2.02 Fabrication

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.

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.

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.

Provide joint covers at 10-foot intervals with no exposed fasteners on face.

Part 3 – Execution

3.01 Installation

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.

Seal moving joints in metal work with elastomeric joint sealants, complying with requirements specified in Division 7 Section "Joint Sealants."

Clean metal surfaces of soldering flux and other substances which could cause corrosion.

Nail flanges of expansion joint units to substrates at spacing of 6 inches o.c.

Composition Stripping: Cover flanges (edges) of work set on bituminous substrate with two 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 and Downspouts

Part 1 - General

1.01 Section Includes

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

Work Includes: Shop fabricated, prefinished aluminum steel gutters and downspouts.

1.02 Related Sections

Section 07 41 00 – Standing Seam Metal Roofing
Section 07 60 00 – Flashings and Sheet Metal
Section 07 63 00 – Vented Roof Edge Fascia

1.03 Submittals

Shop drawings showing layout, profiles, method of joining, anchorage details, etc

1.04 Warranty

Provide manufacturers 20 year written guarantee covering film integrity, fading, chalking.

Part 2 – Products

2.01 Materials

Prefinished Aluminum: 0.063-inch aluminum, commercial quality, primed and finished one side with Kynar based fluropolymer coating. Provide strippable plastic film on face.

1. Peterson Aluminum Corporation "Pac-Clad".
2. Firestone's "Una-Clad".
3. Vincent Metals 'ColorKlad'
4. Metal Era, Inc.
5. Approved equal

2.02 Components

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

Fabricate gutters and downspouts to profiles indicated on drawings.

Field measure site conditions prior to fabricating work.

Hem all exposed sheet metal edges.

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.

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

Kynar 500 paint.

Color: Match Peterson Aluminum 'Colonial Red'

Part 3 – Execution

3.01 Installation

Install gutters, collector heads and downspouts in accordance to manufacturer's instructions.

Seal moving joints in metal work with elastomeric joint sealants, complying with requirements specified in Division 7 Section "Joint Sealants."

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

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

1.02 Summary

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:

Section 07 92 00 – Joint Sealers
Division 22 – Plumbing: Pipe penetrations through fire rated partitions
Division 23 – HVAC: Pipe and duct penetrations through fire rated partitions
Division 26 – Electrical : Conduit penetrations through fire rated partitions

1.04 System Performance Requirements

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.

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.

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.

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.

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.

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

General: Submit the following according to Conditions of Contract and Division 1 Specification sections.

Product data for each type of product specified.

1.06 Quality Assurance

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.

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

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

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.
9. Approved equal

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

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

Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements

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.

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

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.

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.

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

General: Comply with the "System Performance Requirements" article in Part 1, with ASTMC 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

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.

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.

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

Do not proceed to enclose firestopping with other construction until work has been inspected by authorities having jurisdiction, if required.

Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.05 Cleaning

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.

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 Scope of Work

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

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 expansion 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 Submittals

Manufacturer's product data for type of sealant proposed for each application.

Samples of manufacturer's standard range of colors.

Test reports for joint sealants evidencing compliance with requirements.

Part 2 – Products

2.01 Manufacturers

1. Dow Corning Corporation
2. Tremco
3. Pecora Corporation
4. Sonneborn Building Products Chem Rex Inc.
5. Approved equal

2.02 Materials

Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing, field experience, and manufacturers recommendations and written specifications.

Colors: Provide colors indicated for exposed joint sealants or, if not indicated, as selected by architect from manufacturer's full range for this characteristic.

Elastomeric Sealant Standard (for exterior use): Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated, complying with ASTM C 920 requirements.

1. Multi-Part Nonsag Urethane Sealant for Use NT: Type M, Grade NS, Class 25, and as follows:
   a. Uses NT, M, A, and O.
   b. Tremco "Dymeric 511" or equal.
2. Multi-Part Nonsag Urethane Sealant for Use T: Type M, Grade NS, Class 25, and as follows:
   a. Uses T, M, A, and O.

b. Tremco “THC-900/901” or equal.

Acrylic Sealant: (Interior Use - for control or expansion joints) Manufacturers standard one-part non-sag, solvent-release-curing, acrylic terpolymer sealant complying with ASTM C 920 for Type S; Grade NS;

1. Uses NT, M, G, A, and O; except for selected test properties which are revised as follows:
   a. Heat-aged hardness: 40-50
   b. Weight loss: 15 percent
   c. Max. Cyclic movement capability: plus or minus 12-1/2 percent.
2. Use Tremco "Dymonic" Sonneborn NP-1, or Pecora "DYNATROL 1-XL" at control or expansion joints.
3. For typical interior use sealants complying with ASTM C834. Pecora AC 20 or Tremco Acrylic Latex 834.

Latex Sealant: ASTM C 834.

Traffic Grade Sealants: Sealing of horizontal expansion and control joints in exterior concrete walkways

1. ASTM C920--One-part self-leveling moisture curing, polyurethane sealant.
   a. Tremco THC-901
   b. Pecora Corporation ‘Urexpan NR-201’

Sealant Backings, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

Type C: Closed-cell material with a surface skin.

Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

Primer: As recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

Part 3 – Execution

3.01 Installation

General: Comply with joint sealant manufacturer's instructions for products and applications indicated.

Sealant Installation Standard: Comply with ASTM C 790, C 804, C 962, C 1193.

Install exterior sealants when temperature is in the lower third of temperature range recommended by sealant manufacturer.

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

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

Work Includes:

1. Hollow metal door frames
2. Follow metal borrowed lite frames.
3. Standard steel doors

1.02 Related Work Specified Elsewhere

Section 04 06 50 – Masonry Mortar and Grout: Grout filling of hollow metal frames
Section 04 20 00 – Unit Masonry: Preparation of masonry openings
Section 08 71 00 – Door Hardware
Section 08 80 00 – Glass and Glazing
Section 09 90 00 – Painting: Painting of hollow metal doors and frames

1.03 References

ASTM E152 – Methods of Fire Tests of Door Assemblies
DHI – Door Hardware Institute
NFPA 80 – Fire Doors and Windows

1.04 Quality Assurance

Conform to requirements of SDI-100.

Fire rated doors and frames to conform to ASTM E152.

1.05 Submittals

Shop Drawings: With manufacturer's standard details and specifications for steel doors and frames, submit shop drawings showing application to project, as required.

Standards: In addition to other specified requirements, comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" ANSI/SDI-100.

Part 2 - Products

2.01 Manufacturers

Hollow Metal Doors and Frames

1. Ceco Door Products, Brentwood, TN
2. Curries Company, Mason City, IA
3. Mesker Door Inc., Huntsville, AL
4. Pioneer Industries, Inc., Carlstadt, NJ
5. Steelcraft, Cincinnati, OH
6. Approved equal

2.02 Hollow Metal Doors And Frames

Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

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 in accordance to ASTM A 525, with A60 or G60 coating designation, mill phosphatized.

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.

Fire-Rated Assemblies: Provide units that display appropriate UL or FM labels for fire-rating indicated.

Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.

Shop Applied Primer:

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 and Frames

Fabricate units to be rigid, neat in appearance, and free from defects, warp or buckle.

Frames shall be all-welded construction. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible.

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."

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.

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 three 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

Install hollow-metal doors and frames in accordance to manufacturer's instructions and final shop drawings. Coordinate with masonry and stud wall construction.

1. Install frames in accordance to SDI-105.
2. Install fire-rated units in accordance to NFPA Std. No. 80.
3. Finish hardware is specified in Section 08 71 00.

Grout all hollow metal frames. Coordinate installation of electrical work routed through hollow metal door frames with electrical trade.

3.02 Tolerances (Doors and Frames)

Fit doors to frames and floors with clearances specified in ANSI/SDI-100.

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

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

Work Includes:

1. Prefinished Flush Wood Doors

1.02 Related Work

Section 08 11 13 – Standard Steel Doors and Frames
Section 08 71 00 – Door Hardware
Section 08 80 00 – Glass and Glazing

1.03 Quality Assurance

Quality Standards: Comply with NWWDA I.S.1 and AWI "Architectural Woodwork Quality Standards".

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

Shop Drawings indicating location, size, face material, and finishes of each door required.

Samples 1-0" square, of each type of core construction, face material and finish required.

1.05 Warranty

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

Subject to compliance with requirements, provide wood doors by one of the following:

1. Graham
2. Algoma Hardwoods, Inc.
3. Buell Door Company.
4. Eggers Industries.
5. Oshkosh
6. VT Industries

7. Weyerhaeuser Company
8. Approved equal

2.02 Door Types

General Wood Door Product Requirements: Provide doors with same exposed surface material on both faces and edges of each door, unless otherwise indicated.

Interior Solid Core Doors for Transparent Finish: As follows:

1. Faces: Red Oak, rift cut, 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.

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. and 90 min. labeled doors): Where required per Positive Pressure standards, provide fire doors with intumescent concealed behind ¼" matching hardwood stile edge.

Provide solid hardwood blocking with minimum screw pullout strength of 600 lbs. for attachment of all hardware. Through bolting of hardware is not acceptable. Where through bolting may be required by Underwriters Laboratory (UL) to maintain fire rating, solid hardwood blocking is still required.

2.03 Vision Lite Frames

Manufacturers

1. Air Louvers, Inc., Commerce, CA; Model VLF-EZ (single glazing)
2. Anemostat Door Products, Carson, CA; Model 'LoPro'

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 Finish

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

Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.

Install fire-rated doors in corresponding fire-rated frames in accordance to requirements of NFPA No. 80.

Align and fit door in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.

Prefit Doors: Fit to frames for uniform clearance at each edge.

Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

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 31 00 – Access Floor 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: Floor door access panels.

1.02 Related Work

A. Section 03 30 00 – Cast-In-Place Concrete: Floor slab blockouts

1.03 Submittals

A. Submit in compliance with Section 01 33 00 – Submittal Procedures
   1. SD-02 Shop Drawings: show profiles, accessories, location and dimensions.
   2. SD-03 Product Data: Provide manufacturer's product data for all materials in this specification.

1.04 Job Conditions

A. Verify that other trades with related work are complete before installing access floor doors.

1.05 Warranty

A. Manufacturer's Standard Warranty: Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electrical motors, special finishes and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

Part 2 - Products

2.01 Manufacturers

A. The design for the floor door is based on Bilco Company Type 'K'. Subject to compliance with requirements, provide a comparable product by one of the following:
   1. Acudor Products, Inc.
   2. Babcock Davis
   3. Nystrom Building Products
   4. Approved equal

2.02 Access Floor Door

A. Furnish and install where indicated on plans, pre-assembled, single leaf floor access doors set flush with concrete floor slab.
   1. Size: 24" x 24" pre-assembled from the manufacturer.

B. Performance characteristics
   1. Cover: Shall be reinforced to support a minimum live load of 150 psf with a maximum deflection of $1/150^{th}$ of the span.
   2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

C. Cover: Shall be ¼" (6.3 mm) aluminum diamond pattern plate.

D. Frame: Shall be extruded aluminum with strap anchors bolted to the exterior.

E. Hinges: Shall be specifically designed for horizontal installation and shall be bolted to the underside of cover.

F. Lifting mechanisms: Cam-action hinges shall pivot on torsion bars to provide smooth, easy and controlled over operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing.

G. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover.

H. Hardware:
1. Hinges: Cast steel cam-action hinges which pivot on torsion bars shall be provided.
2. Cover shall be equipped with a steel hold open arm that automatically locks the cover in the open position.
3. Cover shall be fitted with the required number and size of torsion bars.
4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
5. Hardware: Shall be zinc plated and chromate sealed. Type 316 stainless steel hardware is available for installation in corrosive environments.

I. Finished: Factory finish shall be mil finish aluminum with bituminous coating applied to the exterior of the frame.

Part 3 - Execution

3.01 Inspection

A. Verify that the vault access door installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.02 Installation

A. Coordinate exact location of floor slab block-outs with HVAC contractor for access to radiant flooring manifold locations.

B. Install floor access doors per manufacturer's instructions.

End of Section 08 31 00

Section 08 36 13 – Sectional Overhead Doors

Part 1 - General

1.01 Work Included

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

Section includes:

1. Electrically operated overhead sectional doors, insulated flush steel design.
2. Operating hardware and supports.

1.02 Related Work

Division 26 – Electrical: Power connections to operators.

1.03 Submittals:

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:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs.
3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
4. Programming features for keypad devices.

Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

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.

1.04 Performance Requirements

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:

Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.

Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 50,000 cycles.

1.05 Warranty

Provide manufacturer’s standard one year warranty on defects in materials and workmanship, and five years from the date of installation on delamination of insulation from its interior and exterior skins.

Part 2 - Products

2.01 Manufacturers:

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 Co. 816R-26
3. Approved equal

2.02 Materials

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 (225 MPa) and a minimum G60 (Z180) zinc coating.

1. Steel Sheet Thickness: 27 gauge.
2. Exterior and Interior Section Face: Flat.

Fabricate door panels from a single sheet to provide sections not more than 24 inches (600 mm) high and nominally 2 inches (50 mm) 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

For insulated doors, provide door sections with continuous thermal-break construction, separating faces of door.

Enclose open section with not less than 16 gauge galvanized steel channel end stiles welded in place. Provide not less than 0.064-inch (1.6-mm) galvanized intermediate stiles, cut to door section profile, spaced at not more than 48 inches (1200 mm) o.c., and welded in place.

Reinforce bottom section with a continuous channel or angle complying with bottom section profile.

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.

Provide reinforcement for hardware attachment.

Insulation: Insulate inner core of steel sections with manufacturer's standard rigid cellular polystyrene or 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.

Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.

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.

Glazing: Provide 1/8" insulated double strength glass lites as illustrated on the overhead door elevations in the drawings.

2.03 Tracks, Supports, and Accessories

Tracks: Provide manufacturer's galvanized steel track system, sized for door size and weight, designed for lift type required and clearances field verified, and complying with ASTM A 653 (ASTM A 653M), for minimum G60 (Z180) zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches (50 mm) o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

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.

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.

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 sensor edge.
2. In addition, provide continuous flexible seals at door jambs for a weather tight installation.

2.04 Hardware

General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

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.

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- (75-mm-) diameter roller tires for 3-inch (75-mm) track and as follows:

Case-hardened steel tires.

Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

Chain Lock Keeper: Suitable for padlock.

Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.05 Counterbalancing Mechanism

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.

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.

Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.

Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.

Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.06 Electric Door Operators

General: Provide electric door operator equal to Overhead Door RSX® Commercial Operators, ¾ hp continuous duty motor, complete with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, integral gearing for locking door, and accessories required for proper operation.

Comply with NFPA 70.

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.

Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

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.

Door-Operator Type: Provide unit consisting of electric motor and the following:

Trolley or drawbar type, with V-belt primary drive, chain and sprocket secondary drive, and quick disconnect-release for manual operation.

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 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.

Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

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.

Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
    a. Self-Monitoring Type: Provide self-monitoring sensor designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door operates to close only with constant pressure on close button.
2. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    a. Provide pneumatically actuated automatic bottom bar.
        1) Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

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

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.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Installation

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.

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

Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

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

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 seven days' advance notice.

End of Section 08 36 13

Section 08 41 00 – Aluminum Entrances and Storefronts

Part 1 - General

1.01 Section Includes

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

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
3. Weatherstripping
4. Perimeter caulking

1.02 Related Sections

Section 08 71 00 – Door Hardware
Section 08 80 00 – Glass and Glazing
Section 10 71 13 – Exterior Sun Control Devices

1.03 Submittals

Product Data: Include fabrication methods, finishing, hardware, accessories and installation recommendations.

Shop Drawings: Include elevations, details, hardware mounting heights, anchorages, expansion provisions and glazing details.

Samples: Pairs of each finish, on 12-inch long section soft extrusions and on 6-inch square sheets.

1.04 Performance Requirements

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° F (67° C).
2. Wind Loading: Withstand uniform test pressure of 20 psf inward and outward when tested in accordance 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.

Fixed Framing Transmission Characteristics:

1. Air Infiltration: Not more than 0.06 CFM per sq. ft. when tested in accordance to ASTM E 283 at an inward test pressure differential of 6.24 psf.
2. Water Penetration: No penetration when tested in accordance 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 45 CRF when tested in accordance to AAMA 1502.
4. Thermal Transmittance (451-T): Not more than 0.65 BTU/(hr. x sq. ft. x deg.F) at 15 mph wind velocity when tested in accordance to AAMA 1503.

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 in accordance to ASTM E 283 at an inward test pressure differential of 1.567 psf.
2. Condensation Resistance: Not less than 48 CRF when tested in accordance 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 in accordance to AAMA 1503.

1.05 Quality Assurance

Manufacturer's Qualifications: 5 years experience in fabrication.
Installer's Qualifications: 5-years experience in installation.

1.06 Warranty

Manufacturer's Product Warranty: Submit as part of project closeout 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

For basis of design, the plans are based on Tubelite, Inc.

1. Entrance Doors: Standard Wide Stile
2. Doors 111A and 111B: Thermally broken equal to Tubelite 'Therml=Block Wide Style'
3. Storefront Framing: Based on Tubelite, Inc. 'T14650 Series', 2 inches by 6-1/2 inch thermally broken.
4. Acceptable Alternate Manufacturers
   a. Kawneer Co.
   b. US Aluminum
   c. EFCO
   d. Approved equal

2.02 Materials

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.

Fasteners: Aluminum, nonmagnetic stainless steel, or other noncorrosive material.

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.

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.

Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

Thresholds: Extruded mill finished aluminum ADA compliant threshold of width required for frame depth.

Glass and Glazing Materials: Comply with requirements of "Glass and Glazing" section.

2.03 Fabricated Components

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

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.

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.

Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.

Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator.

Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

2.04 Aluminum Finishes

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.

1. Finish: AAMA 605.2, Fluoropolymer Coating
    a. Color: Custom color red to match standing seam metal roofing per section 07 41 00.

2.05 Hardware

Hinges: Provide pin and barrel type continuous 14-gauge 304 stainless steel hinges with 0.25 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

Pulls: Provide entrance door manufacturer's standard 1" dia. x 10" (center to center) wire pull handle.

Push: 1-inch dia. bent bar with 90 deg. x 2-1/4 projection at both ends.

Threshold: Manufacturer's standard extruded aluminum threshold machined to fit door type, size and type of hinge. Thresholds shall be ADA compliant, ½" in height and beveled to the floor on both sides to provide easy access for wheelchairs and strollers.

Weatherstripping: Manufacturer's standard replaceable pile weathering or vinyl gasket.

Sweep: Manufacturer's standard vinyl sweep for mounting to bottom edge of door with concealed fasteners on a mounting strip.

Deadbolt: Adams Rite Maximum Security Deadlock MS 1850A, standard long throw bolt of 5-ply laminated steel.

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 Latch: Schlage AD-Series x 626 Sparta (No Substitutions)

2.06 Glass and Glazing Materials

Glass and Glazing Materials: As specified in Section 08 80 00.

2.07 Perimeter Caulking

One-part, low modulus, high performance, neutral curing, non-staining, 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

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.

Separate aluminum and other corrodible metal surfaces from sources of corrosion at points of contact with other materials.

Adjust operating hardware to function properly.

Clean system promptly after installation.

3.02 Hardware Schedule
HARDWARE GROUP AL-1
Each single aluminum door to have:
DR. 101A, 101B, 111A, 111B

1 Each	Continuous Hinge	Markar FM300 32D
1 Each	Push/Pull	
1 Each	Threshold	Manuf. Std. (see par. 2.05 above)
1 Each	Weatherstrip	Manuf. Std. (see par. 2.05 above)
1 Each	Sweep	Manuf. Std. (see par. 2.05 above)

End of Section 08 41 00

Section 08 71 00 – Door Hardware

Part 1 – General

1.01 Work Included
Applicable provisions of Division 1 shall govern all work under this section.

Section includes:

1. Furnish all finish door hardware listed in the hardware schedule specified herein, or required by the drawings.

1.02 Related Work
Section 06 20 00 - Finish Carpentry
Section 08 11 13 - Steel Doors and Frames
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.
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.D.A.-Americans with Disabilities Act.
ANSI A117.1 Specification for making facilities accessible to physically handicapped people.

NFPA 80 Standards for Fire Doors and Windows
NFPA 101 Life Safety Code
U.L. Building Material Directory
D.H.I. Recommended Locations for Architectural Hardware
Applicable State and Building Codes, including IBC 2000

1.04 Submittals

Submit five copies of a detailed hardware schedule, vertical format. Prepare under the supervision of an AHC, registered Architectural Hardware Consultant, and under provisions of Division One.

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. Resubmit five copies of the corrected schedule when required.

Keying Schedule: After receipt of approved hardware schedule, submit a copy of keying schedule as a result of a keying meeting between the owner and the Hardware Supplier.

Samples: If so directed by the architect, submit samples of finish hardware items for approval. Properly identify each sample as to make and number, and finish.

Templates: Furnish a copy of approved hardware schedule, along with applicable templates for factory-prepared hardware to each door and frame fabricator.

Electrical Hardware: Submit electrical specifications and applicable information to the electrical contractor after receipt of the approved hardware schedule.

1.05 Quality Assurance

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.

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

Deliver, store and handle in accordance to Division One. Mark each original container with a door number that corresponds to the approved hardware schedule for the installation location.

Receive, inventory and store hardware in a secure and dry environment: protect against loss and damage.

Report any shortages to the hardware supplier no later than 48 hours after receipt of delivery to the job site.

Stockpile items sufficiently in advance to ensure their availability.

Part 2 – Products

2.01 Acceptable Manufacturers

Products	Specified	Acceptable
Hinges	McKinney	Stanley, Hagar, PBB
Closers	LCN	Sargent, Dorma
Flush Bolts	Rockwood	DCI, Trimco, Ives
Locks and Latches	Schlage	Sargent, Best
Electric Cylindrical Locksets	Schlage	Sargent, Best
Electric Locks w/ Keypad	Schlage AD-Series	No substitutions
Push/Pull	Rockwood	Trimco, Hager
Protective Plates	Rockwood	Burns, Hager
Overhead Stops, Holders	Glynn Johnson	ABH, Dorma
Wall and Floor Stops	Rockwood	Trimco, DCI
Threshold, Sweeps and Weatherstrip	Reese	Pemko, National Guard

2.02 Hinges

Acceptable manufacturers and respective catalog numbers:

Description	PBB	Stanley	McKinney	Hager
Std. Wt. Plain Bearing Steel	PB81	F179	T2714	1279
Std. Wt. Ball Bearing Steel	BB81	FBB179	TA2714	BB1279
Std. Wt. Ball Bearing–nonferrous	BB21/BB51	FBB191	T4B3786	BB1168
Hvy. Wt. Ball Bearing Steel	4B81	FBB168	T4B3786	BB1168
Hvy. Wt. Ball Bearing-nonferrous	4B21/4B51	FBB179	T4B3386	BB1199

Hinges supplied must be tested and comply with ANSI/BHMA standard for consistency, wear and corrosion resistance.

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

Type: Furnish as indicated in hardware groups.

2.03 Flush Bolts

Acceptable manufacturers and respective catalog numbers:

Description	Rockwood	Ives	Trimco	DCI
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

Furnish a dustproof strike for all bottom bolts.

2.04 Locks and Latches

Acceptable manufacturers and respective catalog numbers:

Description	Best	Schlage	Sargent
Heavy-Duty Mortise	45H	L9000	8200
Heavy-Duty Grade 1 Cyl.	93K	ND Series	10 Line

Furnish lever designs as indicated in groups.

Furnish lock types and functions as specified in the hardware schedule and as follows:

1. Provide 2 ¾" backset.
2. Provide 2 ¾" x 1 1/8" T strike with a dust box for use in wood doors or frame.
3. Provide 4 7/8" x 1 ¼" 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. Lockets and cores to be of same manufacturer to maintain complete lockset warranty.

2.05 Exit Devices

Acceptable manufacturers and respective catalog numbers:

Description	Von Duprin	Precision	Sargent
Wide Stile Rim	98	2100	8800
Wide Stile Vert. Rod	9827	2200	8700
Wide Stile Conc Vert. Rod	9875	2800	8600
Wide Stile Mortise	9875	2300	8900
Narrow Stile Rim	35	2400	8500
Narrow Stile Conc Vert. Rod	3547	2600	8400

Furnish exit device types and functions as specified in the Hardware Schedule.

Lever handles supplied with exit devices shall match the design specified for locks/latches.

2.06 Pulls, Push Bars, Push/Pull Plates
Acceptable manufacturers and respective catalog numbers:
Description Rockwood TrimcoBurns

Supply product as listed in groups and equal to acceptable manufacturers

2.07 Door Closers
Acceptable manufacturers and respective catalog numbers:

Description	Dorma	LCN	Sargent
Heavy Duty Reg. Arm	8900	4041	350
Heavy Duty Parallel Arm	8900 SPA	4041 EDA	350 PED
Heavy Duty Stop Arm	8900DS	4041 Cush	350 PS

2.08 Low-Energy Automatic Operators
Acceptable manufacturers and respective catalog numbers (shall be included in the hardware package).

Description	LCN	Norton
Operator – Push Side	4640	6960
Operator – Pull Side	4630	6910
Hardwired Wall Switch	956	685
Wireless Wall Switch	957	574
Wireless Receiver	931	RFI

Provide arms, mounting plates, sizes, stops, and any other 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 the requirements of ANSI A159.19.

2.09 Protective Plates
Acceptable manufacturers: Rockwood, Trimco, Burns, Hager

All kickplate heights shall be as listed in groups and 2 inches less door width single doors and 1 inch less for pairs.

Thickness shall be 0.050” (16 gauge).

2.10 Overhead Stop/Holders
Acceptable manufacturers and respective catalog numbers:

Description	ABH	Dorma	Glynn Johnson
Heavy Duty Surface	9000	900	90
Heavy Duty Concealed	1000	910	100
Standard Duty Surface	4400	700	450
Standard Duty Concealed	4000	710	410

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

Acceptable manufacturers and respective catalog numbers:

Description	Rockwood	Hager
Wrought Convex Wall	407	232W
Wrought Concave w/Toggle	409	237W

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.

Wall stops shall not be mounted to casework, cabinet work, sidelights or equipment.

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

Acceptable manufacturers and respective catalog numbers:

Description	Reese	Pemko	National Guard
Threshold	5205	171A	425A
Sweep	323	315N	200N
Sweep	967	18133CP	OV633
Weatherstrip	970	45100CP	603
Weatherstrip	DS78	315CR	130N
Gasket	797B	588	1010

Where specified in groups, furnish the above products unless otherwise detailed.

2.13 Door Hardware Finishes

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

2.14 Keying
To be determined after consultation with owner and architect.

Part 3 - Execution

3.01 Examination
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
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.

Set units level, plumb and true to the line and location. Prepare and reinforce the attachment substrate as necessary for proper installation and operation.

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.

If manufacturers' instructions do not call out a mounting location, refer to the Door and Hardware Institute's publication Recommended Locations for Architectural Hardware.

Delivery to the owner, one complete set of installation and adjustment instructions, as well as all tools that were furnished with the hardware.

3.03 Adjustment and Cleaning
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.

Instruct the owner's personnel in the proper adjustments of the hardware as needed.

Clean and restore hardware to the original finish.

3.04 Hardware Schedule

Hardware Group 1

Each single aluminum door to have:

DR. 101A, 101B

1 Each	Exit Device	98Lx996L-Rx 17 x 630	Von Duprin
1 Each	Rim Cylinder	20-022 626	Schlage
1 Each	Door Operator	4630	LCN
1 Each	Wall Stop	409 32D	Rockwood
2 Each	Actuators	956	LCN

Continuous hinge, weatherstrip, sweep,and threshold by Aluminum Entrance supplier.

Hardware Group 2

Each single door to have:

DR. 101C

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Lockset	ND70PD x SPA 626	Schlage
1 Each	Door Closer	4040 CUSH	LCN
1 Each	Kick Plate	16”x 2” LDW 320	Rockwood
1 Each	Smoke Seal	797B	Reese

Hardware Group 3

Each pair of doors to have:

DR. 102A and B, 116B and C

6 Each	Butts	TA2714-26D NRP 4.5 X 4.5	McKinney
1 Each	Lockset	ND80PD x SPA 626	Schlage
2 Each	Door Closer	4040 CUSH	LCN
1 Set	Flush Bolts	550 26D	Rockwood
1 Each	Smoke Seal	797B	Reese

Hardware Group 4

Each single door to have:

DR. 103,107A, 107B, 115

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Lockset	ND 70PD x SPA 626	Schlage
1 Each	O.H. Stop (DR. 103 107A and 107B)	GJ450S x 652	Glynn Johnson
1 Each	Wall Stop (DR. 115)	409 32D	Rockwood

Hardware Group 5

Each single door to have:

DR. 104,105,106

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Privacy Set	ND40S x SPA 626	Schlage

1 Each	Closer	4010 REG	LCN
1 Each	Wall Stop	409 32D	Rockwood

Hardware Group 6
Each single door to have:
DR. 110A, 110B, 114

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Lockset	ND70PD x SPA 626	Schlage
1 Each	O.H. Stops (DR. 110A)	GJ4505x626	Glynn Johnson
1 Each	Wall Stop (DR. 114)	409 32D	Rockwood
1 Each	Floor Stop (DR. 110B)	438	Rockwood

Hardware Group 7
Each single door to have:
DR. 113

3 Each	Butts	TA2714-26DNPD 4.5 X 4.5	McKinney
1 Each	Lockset	ND50PDxSPA 626	Schlage
1 Each	Wall Stop	409 32D	Rockwood

Hardware Group 8
Each single door to have:
DR. 117A, 117D

3 Each	Butts	TA2314-26DNPD 4.5 X 4.5	McKinney
1 Each	Electric Lockset	AD-200-CY-70-MTK-SPA-PD	Schlage
1 Each	Closer	4110 CUSH	LCN
1 Each	Kickplate	16”x 2” LDW 32D	Rockwood
1 Each	Weatherstrip	815A	Reese
1 Each	Sweep	323A	Reese
1 Each	Threshold	S40SA	Reese

Hardware Group 9
Each single door to have:
DR. 117B, 117C

3 Each	Butts	TA2714-26D 4.5”x4.5”	McKinney
1 Each	Lockset	ND80PD x SPA 626	Schlage
1 Each	Closer	4110 CUSH	LCN
1 Each	Kickplate	16’ X 2’ LDW 32D	Rockwood
1 Each	Weatherstrip	815A	Reese
1 Each	Sweep	323A	Reese
1 Each	Threshold	S40SA	Reese

Hardware Group 10
Each single door to have:
DR 109A

3 Each	Butts	TA2714-26D 4.5 x 4.5	McKinney
1 Each	Electric Lockset	ND96PDEU	Schlage
1 Each	Power Transfer	EPT2	Von Duprin
1 Each	Power Supply	505-ULAC-KLC	Schlage
3 Each	Push Button Switch	621AL-AA-L2	Schlage
1 Each	Door Closer	4110 CUSH	LCN
1 Each	Kick Plate	16”x 2” LDW 320	Rockwood
1 Each	Floor Stop	442	Rockwood

Hardware Group 11
Each single aluminum doors to have:
DR. 109B

2 Each	Spring Hinges	1552-26D 4.5”x 4.5”	McKinney
1 Each	Edge Guard	EG341	McKinney
1 Each	Floor Stop	442	Rockwood

Hardware Group 12
Each single aluminum door to have:
DR. 111A, 111B

1 Each	Electric Lockset	AD-200-993R-70-MTK-SPA-PD	Schlage
1 Each	Exit Device	98EO 630	Von Duprin
1 Each	Door Closer	4110 EDA W/18 DROP PLATE	LCN
1 Each	Continuous hinge, weatherstrip, sweep, and threshold by aluminum supplier		

Hardware Group 13
Each single door to have:
DR. 112

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Electric Lockset	AD-200-CY-70-MTK-SPA-PD	Schlage
1 Each	Door Closer	4110 CUSH	LCN
1 Each	Kick Plate	16” x 2” LDW 320	Rockwood
1 Each	Smoke Seal	797B	Reese

Hardware Group 14
Each single door to have:
DR. 116A

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Lockset	ND 80PD x SPA 626	Schlage
1 Each	Closer	4110 CUSH	LCN
1 Each	Smoke Seal	797B	Reese

Hardware Group 15
Each single door to have:
DR. 001A, 001B

3 Each	Butts	TA2714-26D 4.5 x 4.5	McKinney
1 Each	Lockset	ND 80PD x SPA 626	Schlage
1 Each	Wall Stop	409 32D	Rockwood

End of Section 08 71 00

Section 08 80 00 – Glass And Glazing

Part 1 – General

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

Glass and glazing for sections referencing this section for products and installation.

1.02 Related Sections
Section 08 11 13 - Standard Steel Doors And Frames
Section 08 14 16 – Flush Wood Doors
Section 08 41 00 – Aluminum Entrances

1.03 References
Glazing Standard: Comply with GANA "Glazing Manual" and FGMA "Sealant Manual".

Safety Glazing Standard: Comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

1.04 Submittals
Samples of each glass indicated, except for clear single pane units; and of each type of sealant or gasket exposed to view.

Certificates of compliance from glass and glazing materials manufacturers.

Part 2 - Products
2.01 Manufacturers
For basis of design, the plans are based on the PPG Solarban67.

Acceptable manufacturers include”
1. Viracon.
2. Pilkington Libbey-Owens-Ford.
3. Visteon Glass, Inc.
4. Oldcastle Glass

2.02 Flat Glass Materials

Primary Glass Products: Comply with ASTM C 1036 for the following:

Clear Float Glass: Type I, Class 1, Quality q3.

Uncoated Heat-Treated Glass Products: Comply with ASTM C 1048 and with manufacturing process indicated for the following:

Clear Tempered Float Glass: Kind FT, Condition A, Type I, Class 1, Quality q3.

2.03 Sealed Insulating Glass Units:

General: Comply with requirements of ASTM E 774 for Class A units and the following:

1. Clear Tempered Float Glass: Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Color: Clear
3. Visible Light Transmission: 54%
4. U-Values: Winter 0.29; Summer: 0.27
5. Solar Heat Gain Coefficient: 0.33
6. Low E coating on #2 surface

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.

1. Sealing System: Manufacturer's standard.
2. Spacer Material: Manufacturer's standard metal.

2.04 Fire Rated Glazing Materials (Impact Safety Rated)

Manufacturer: SGG Swissflam N2 / SGG Contraflam N2 as manufactured by Vetrotech Saint-Gobain NA, Auburn, WA Telephone 888-803-9533

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. feet)
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 and II)
6. STC Rating: Up to 44dB

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.

Fire Rating: Fire-rating listed and tested by Intertek Testing (WHI) for fire rating scheduled at opening locations in drawings, when tested in accordance 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 and 10C) (UL 263)

2.05 Spandrel Glass Units (Insulated Glass Units)
Outboard Lite: ¼-inch tinted float glass, fully-tempered.

Inboard Lite: ¼-inch clear float glass, fully-tempered with ceramic frit coat opacifier applied to #4 glass surface and Low 'E' coating on #3 surface.

2.06 Glazing Accessories
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).

Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

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.

2.07 Glazing Schedule

GL-1 : Tempered Glass
- Interior glazing at non-rated doors, sidelights, and borrowed lights
- ¼" thick, tempered, clear, unless otherwise indicated

GL-2 : Fire-Rated Glass
- Glazing located in fire rated doors and sidelites

GL-3 : Insulated glass units
- Glazing located in exterior doors and sidelites
- Sealed Insulating Glass Units consisting of:
  ¼" tempered glass, exterior pane
  ½" air space
  ¼" thick clear tempered glass, interior pane
  low-E coating

GL-4 : Insulated glass units
- Glazing located in exterior storefront framed walls
- Sealed Insulating Glass Units consisting of:
  ¼" tempered clear float glass, exterior pane
  ½" air space
  ¼" thick clear tempered glass, interior pane, with low-E coating

GL-5 : Insulated spandrel glass units
- Glazing located in exterior storefront framed walls, upper units
- Sealed Insulating Glass Units consisting of:
  ¼" tinted tempered glass, exterior pane
  ½" air space
  ¼" colored tempered spandrel glass, interior pane

Part 3 - Glass Installation (Glazing)

3.01 Examination

Verify that openings for glazing are correctly sized and within tolerance.

Glazing contractor shall confirm all field measurements of openings scheduled to receive glass prior to fabrication.

3.02 Preparation

Clean contact surfaces with solvent and wipe dry.

Seal porous glazing channels or recesses with substrate compatible primer and sealer.

3.03 Glazing

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.

Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

Protect glass from contact with contaminating substances resulting from construction operations; remove any such substances by method approved by glass manufacturer.

3.04 Cleaning

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

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

This section includes labor, materials, and equipment for the installation of factory glazed, translucent panel, including accessories, weep system and trim in accordance 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

Section 06 10 00 – Rough Carpentry: Treated wood blocking
Section 07 60 00 – Flashing and Sheet Metal: Sill flashing
Section 07 92 00 – Joint Sealants

1.03 Submittals

Submit shop drawings and color samples in accordance to Division 1, Submittals.

Test reports to be furnished by sandwich panel system manufacturer in accordance to Division 1, Submittals. 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)

Proof of regular, independent quality control monitoring under a nationally recognized building code review and listing program shall be submitted.

1.04 Quality Assurance

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 (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

Performance Requirements: The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1.05 Product Handling

Store translucent panels on the long edge, several inches above the ground, blocked and under cover to prevent warping in accordance to manufacturer's storage and handling instructions.

Part 2 - Products

2.01 Manufacturers

1. Kalwall Corporation
2. Major Industries
3. Approved equal

Manufacturers of translucent panels wishing to bid as a deductive alternate must submit a complete list of deviations from this specification at least 2 weeks prior to bid date and will be approved to bid as a deductive alternate in writing no later than 10 days prior to bid due date.

2.02 Materials – Translucent Panels

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.

Flammability – The interior face sheet shall be U.L. listed and have a flamespread rating no greater than 50 and smoke developed no greater than 250 when tested in accordance 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.

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 5 years outdoor South Florida weathering at 5 degrees facing south, determined by the average of at least 3 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.

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 ± 10% in thickness and be uniform in color.

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

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-inch. The I-beam grid shall be machined to tolerances of not greater than ± 0.002-inch. Thermal break shall be minimum 1-inch. 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.

Thermally Broken panels shall withstand 1200°F fire for minimum one hour without collapse or exterior flaming.

2.04 Adhesive

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".

Minimum tensile strength shall be 750 PSI by ASTM C-297 after 2 exposures to 6 cycles each of the aging conditions prescribed by ASTM D-1037.

Minimum shear strength by ASTM D-1002 after exposure to 5 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

Panels shall have a thickness of 2¾-inches with a "U" factor by NFRC certified laboratory of 0.10, light transmission of 8% and shading coefficient of 0.07. Complete system shall be NFRC certified.

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-inches at 30 psf in 10-feet by ASTM E-72.

Grid pattern shall be nominal 12" x 24" shoji.

The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

2.06 Battens And Perimeter Closure System

Closure system shall be extruded 6063-T6 and 6063-T5 thermally broken aluminum screw clamp-tite.

All battens and perimeter closures to be supplied with 300 series stainless steel screws (excluding final fasteners to the building).

All exposed aluminum to be architectural corrosion resistant finish which meets the performance requirements of AAMA 2604, color to be selected from manufactures standards.

Maintain continuous air barrier and vapor retarder throughout assembly in line with inside face of sandwich panel.

Provide flashing tabs at every batten and perimeter joint to prevent air infiltration.

2.07 Flexible Sealing Tape

Vapor retarding sealing tape shall be manufacturer's standard to prevent air infiltration into panel cells.

Part 3 - Execution

3.01 Preparation
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
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.

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.

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

Work Included: Provide metal studs, furring channels, and accessories as indicated on the drawings, as specified herein.

1.02 Related Sections
Section 06 10 00 – Rough Carpentry: Rough wood blocking within stud framing.
Section 07 21 16 – Blanket Insulation
Section 09 29 00 – Gypsum Board Assemblies

1.03 Submittals
Manufacturer’s product information and installation instructions.

Submit shop drawings of prefabricated work indicating component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.

1.04 References

ASTM C 645 – Standard Specification for Nonstructural Steel Framing Members, 2000.

ASTM C 754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

ASTM C 1513 – Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

AISI Specification for the Design of Cold-Formed Structural Members.

AISI – Standard for Cold-Formed Steel Framing General Provisions

1.05 Delivery, Storage and Handling

Store products in manufacturer's unopened packaging until ready for installation per requirements of ASTM C 645.

Part 2 – Products

2.01 Manufacturers

1. Dietrich Metal Framing, Miami, FL
2. Clark Steel Framing Systems, Middletown, Ohio
3. Nuconsteel (A Nucor Company), Denton, TX
4. Approved equal

2.02 Components

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.

Runner Track: Cold-formed galvanized steel in conformation with AISI Specifications for Design of cold-formed steel structural Members.

Thickness equal to stud thickness minimum or heavier per design required.

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 ½" deep "z" profile with ¾-inch 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-inch deep hat shaped corrosion-resistant framing component used to furr out masonry wall and ceiling assemblies.
3. Resilient Channels: Single leg, 25 gauge x ½-inch deep resilient channels.

2.03 Accessories

Bridging: 16 ga. corrosion-resistant galvanized steel U-shaped, ¾-inch wide channels with clip angles for attachment to studs.

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.

Touch-Up Paint: Provide stud manufacturer's standard zinc rich, containing 95-percent metallic zinc.

2.04 Materials

Cold-Formed Steel: Complying with ASTM A 1003/A 1003M; unless indicated otherwise.

Galvanized Coating: G40 coating weight minimum, complying with ASTM C 645.

2.05 Fabrication

General: Framing components may be preassembled into panels prior to erecting.

Fabricate panels square, with components attached in a manner so as to prevent racking or distortion.

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.

Fasteners: Fasten components using self-tapping screws or welding.

Part 3 – Execution

3.1 Examination

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.

If substrate preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

3.2 Erection

Install cold-formed framing in accordance to requirements of ASTM C 745.

Framing Installation:

1. Erect framing and panels plumb, level and square in strict accordance with approved drawings.
2. Handle and left 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 in accordance 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.

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 ½" 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.

3.3 Protection

Protect installed products until completion of project.

Replace damaged metal stud framing members prior to hanging gypsum board.

End of Section 09 22 16

Section 09 29 00 – Gypsum Board Assemblies

Part 1 - General

1.01 Work Included

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

Work Includes

1. Gypsum Board and Joint Treatment
2. Gypsum Board Ceiling Suspension System
3. Acoustical Sound Attenuation Blanket Insulation
4. Drywall Moldings, Furring and Accessories

1.02 Work Included Under This Section But Specified Elsewhere

Section 06 10 00 – Rough Carpentry: Wood blocking
Section 07 21 16 – Blanket Insulation
Section 09 22 16 – Non-Bearing Metal Wall Framing
Section 09 90 00 – Painting

1.03 References

ASTM C36 – Gypsum Wall Board
ASTM C475 – Joint Treatment Materials for Gypsum Wallboard
ASTM C 1002 – Gypsum Board Screws
ASTM C514 – Nails for the Application of Gypsum Wallboard
ASTM C 840 – The Standard Specification for Application and Finishing of Gypsum Board
Gypsum Association publication GA 214-90: Recommended Specifications: Levels of Gypsum Board Finish
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

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.
4. Approved equal

2.02 Materials

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

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 ½ deep "z" profile with ¾" 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.
3. Resilient Channels: Single leg, 25 gauge x ½" deep resilient channels.

Steel Framing Components For Suspended Gypsum Board Ceilings

1. General: Provide components complying with ASTM C635. 2. Wire Hangers: Galvanized carbon steel, soft temper, prestretched, 12-gauge wire.
2. Suspension System
   a. Main Tees: Fire-Rated Heavy Duty classification, 144" long, with integral reversible splice with knurled face. 1½" face, 1.617" high.
   b. Cross Tees: 1½" high x 48" long with 1½" wide face.
   c. Wall Moldings: Single web with knurled face, 1" x 1½"

Trim Accessories: ASTM C 840: mfr'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.
4. Reveal Molding: "F" Reveal molding
   a. Fry Reglet Model No. DRMF-625-50
   b. Flannery, Inc., San Fernando, CA
   c. Gordon, Inc., Bossier City, LA
   d. Approved equal

Gypsum Board Joint Treatment Materials: ASTM C 475 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.

Primer-Surfacer: USG 'TUFF-HIDE' vinyl acrylic latex based coating.

Miscellaneous Materials: As follows, recommended by gypsum board mfr

1. Laminating Adhesives: Product recommended by gypsum board mfr
2. Fastening Adhesive for Wood: ASTM C 557
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.

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
    e. Approved equal

Part 3 - Execution

3.01 Inspection

Verify that site conditions are ready to receive work and opening dimensions are as indicated on the shop drawings.

Beginning of installation means acceptance of existing surfaces.

3.02 Metal Furring Installation

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.

Space furring channels maximum 16 inches on center, not more than 2 inches from abutting walls. Continue furring channels from floor to 12 inches above finished ceiling at suspended ceiling locations.

3.03 Reveal Molding

Install aluminum “F” reveal molding where indicated on the drawings. Corners shall be neatly mitered.

Paint field applied fasteners to match color selected for aluminum reveal channel.

3.04 Ceiling Suspension System

Standard Reference: Install in accordance to ASTM C636, CISCA installation standards, and other applicable code references.

Install in accordance to manufacturer's current printed recommendations.

Component and Hanger Wire Installation: Main tees shall be spaced a maximum of 48 inches on center and supported by hanger wires spaced a maximum of 48 inches o.c. and as specified by UL Fire Resistance Directory attaching hanger wires directly to structure above. Cross tees shall be spaced per manufacturers' recommendations and as specified by UL Fire Resistance Directory.

Hanger wires are required within 12 inches on both sides of a pivoted splice clip. At least one hanger wire is required within 12 inches of the transition clip. Do not support wires from mechanical and/or electrical equipment.

3.05 Acoustical Sealant

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.

3.06 Installation (Gypsum Board)

Install and finish gypsum board to comply with ASTM C 840 and as follows:

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.

Screw gypsum board to metal framing and 'Z'-furring channels.

Screw both layers to supports where double-layer work is indicated or otherwise required.

Direct Bonding: Comply with mfr's recommendations where gypsum board is indicated to be directly bonded to substrate.

Do not bridge building expansion joints. Leave space of the width indicated between boards, and trim both edges for installation of sealant or gasket.

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.

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 HiLo 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.

3.07 Drywall Finishing

Apply joint tape and joint compound at joints between gypsum boards. Apply compounds indicated below at accessory flanges, penetrations, fastener heads and surface defects.

Install compound in three coats (plus pre-fill of cracks where recommended by mfr); sand between coats and after last coat.

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 mfr's directions.

Finish: Level 4 smooth finish (GA 214-96)

Primer-Surfacer:

1. Mix primer-surfacer coating as directed by manufacturer. Do not thin or intermix with any other product.
2. Apply primer-surfacer coating with airless spray equipment that meets the pressure range recommended by manufacturer for minimum Wet Film Thickness and coverage per gallon.
   a. Wet Film Thickness: 15-20 mils.

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

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.

ASTM INTERNATIONAL (ASTM)

ASTM C 1027(2009) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
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
ASTM C 648(2004; R 2009) Breaking Strength of Ceramic Tile
ASTM D 4068(2009) Chlorinated Polyethylene Sheeting for Concealed Water-Containment Membrane
ASTM E 2129(2005) Standard Practice for Data Collection for Sustainability Assessment of Building Products

GREEN SEAL (GS)

GS-36(2000) Commercial Adhesives

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEIGreenguard Standards for Low Emitting Products

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCA Hdbk (2008) Handbook for Ceramic Tile Installation

1.04 Submittals

A. Submit the following in accordance 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 Manufacturers

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
6. Approved equal

C. Tile Grout

1. Polyblend
2. Mapei
3. Hydroment
4. TEC
5. Approved equal

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'
      c. Approved equal

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.
   1. 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)
   1. Daltile 'Brixton™ Glazed Ceramic
   2. Size: 6" x 6"
   3. Color: 'Bone' BX01

B. Porcelain Floor Tile (PT-1)
   1. Daltile 'City View™'
   2. Size: 12" x 12"
   3. Color: 'Downtown Nite' CY04

C. Porcelain Tile Base (PT-2)
   1. Daltile 'City View™'
   2. Size: 6" x 12" Cove Base
   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 in accordance 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, in accordance 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 in accordance to manufacturer's recommendations.

C. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

D. Apply grout sealer as recommended by tile manufacturer.

End of Section 09 31 00

Section 09 51 00 – Acoustical Tile Ceilings

Part 1 – General

1.01 Work Included

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

Work Includes

1. Suspended metal grid ceiling system.
2. Acoustical tile
3. Accessories

1.02 Related Work

Division 23 – Mechanical: Air diffusion grilles in ceiling system
Division 26 – Electrical: Light fixtures in ceiling system

1.03 References

ASTM C635 – Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
ASTM C636 – Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
FS HH-I-521 – Insulation Blankets, Thermal Mineral Fiber, for Ambient Temperatures

1.04 Submittals

Submittals: In addition to product data for each type of acoustical panel and suspension system required, submit the following:

1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.

Attic Stock: Prior to project close-out, deliver replacement material to owner in the amount of 1 box for every 50 installed, or fraction thereof (2 boxes minimum), of each type, pattern, color or size.

1.05 Fire-Test-Response Characteristics

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

Manufacturer's 15-year limited warranty against sagging or warping due to humidity conditions.

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

Acoustical Panel Products:

1. Armstrong World Industries, Inc.
2. The Celotex Corporation
3. USG Interiors Inc.
4. Approved equal

2.02 Manufacturers – Suspension Grid

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
5. Approved equal

2.03 Materials

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.

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.

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:

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.

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'

Manufacturers: Armstrong #1732 *Fine Fissured* w/ Humiguard Plus or approved equivalent products from Celotex and USG subject to approval by architect.

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.

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 fur 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.

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.)

Wall Edge Molding: Provide metal channel type, with single flange exposed.

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:

1. 15/16 inch 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.

Part 3 – Execution

3.01 Installation

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.

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.

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 inches o. c. Mitre corner joints.

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.

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. Heterogeneous sheet vinyl flooring

C. Vinyl wall base

1.02 Related Sections

A. Section 09 31 00 – Tiling: Flooring Transition Strip

1.03 Submittals

A. Submit the following in accordance to Section 01 33 00 – SUBMITTAL PROCEDURES:

1. 1. SD-03 Product Data: Manufacturer's product data and installation instructions for each type of resilient flooring.
2. SD-04 Samples: 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
6. Smoke Developed: 450 or less
7. 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. Color: Armstrong ‘Graphite Gray 61’

Part 3 - Execution

3.01 Examination: Beginning of installation means acceptance of existing substrate and site conditions.

3.02 Preparation: Apply primer to concrete substrates as recommended by flooring manufacturer.

3.03 Installation: Comply with flooring manufacturer's recommendations for type(s) of materials, adhesives, project conditions, and intended use.

3.04 Cleaning: Clean floors and accessories after installation in accordance to flooring manufacturer's instructions.

End of Section 09 65 00

Section 09 68 00 – Carpeting

Part 1 – General

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

Section includes;

1. Modular carpet tile
2. Stitched carpet wall base with same pattern as modular carpet tile

1.02 References
ASTM E84 – Surface Burning Characteristics of Building Materials

1.03 Submittals
Submit Product Data for each type of carpet, and the following:

Samples two full tile samples illustrating color and pattern for each carpet material specified.

Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

Maintenance Data: Include maintenance procedures. Recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.04 Quality Assurance
Contractors Certification: Provide certification testifying installation contractor is certified by the Floor Covering Installation Board (FCIB).

1.05 Warranty
Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

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.

Chair pads must not be required for carpet warranty coverage.

Warranty shall be for a specifically defined non-prorated period of twenty years. "Lifetime" warranties are not acceptable.

Warranty shall not exclude carpet product installed on stairs provided it is properly installed and maintained.

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

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.

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.

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.

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

For basis of design, the plans are based on Interface 'Kamala'

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. The New Patcraft and Designweave
4. J&J Commercial
5. Approved equal

2.02 Materials

Modular Carpet Tile

1. Tufted texture loop
2. Antimicrobial Treatment: (AATCC 138 Washed) (AATCC 174 Parts 2 and 3)
3. Soil/Stain Protection: Protekt® with Duratech®
4. Size: 50 cm x 50 cm.

5. Total Thickness: .295 inch
6. Fiber System: Type 6,6 Nylon Antron Lumina®
7. Dye Method: 100% Solution Dyed
8. Pile Density: 7,886
9. Backing: GlasBac® Tile

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
4. Flame Spread: 25 or less per ASTM E 84.

Trowelable Underlayments and Patching Compounds: As recommended by the carpet manufacturer.

3000 psi minimum Portland cement based leveling compound and substrate primer in accordance to carpet manufacturers recommendations.

2.03 Carpet Color: 101587 ‘Saki’

2.04 Stitched Carpet Base

Provide matching 4-inch high stitched edge carpet base where indicated on the plans and Room Finish Schedule.

Part 3 – Execution

3.01 Examination

Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 feet, and are ready to receive work.

Verify that concrete floors are dry to a maximum moisture content of 7 percent and exhibit Negative alkalinity, carbonization, or dusting.

Beginning of installation means acceptance of existing substrate and site conditions.

3.02 Preparation

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.

Clean floors and apply min. 3000 psi. Portland cement based leveling compound and substrate primer if required, in accordance to flooring manufacturer's instructions. Start of laying flooring product will indicate acceptance of floor slab conditions.

Prohibit traffic from area until filler is cured.

Vacuum clean substrate.

Project Conditions: Comply with CRI 104, Section 6: "Site Conditions."

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:

Remove subfloor coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone.

Apply manufacturer's recommended Primer Barrier Coating over entire surface.

3.03 Installation
Apply TacTiles at each corner along anchor rows and perimeter walls in accordance to manufacturer's guidelines.

TacTiles must be applied under every cut tile and any adjoining tile to the cut tile. Install TacTile an any area that will be exposed to high foot traffic and/or heavy rolling traffic.

Vacuum carpet using commercial machine with face-beater element.

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 in accordance to manufacturers recommendations.

Remove and dispose of debris and unusable scraps.

Protection: Comply with CRI 104, Section 15: "Protection of Indoor Installation."

Apply stitched carpet base to al 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
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 Summary

This section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.

Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified in other sections.

Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be 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 supervising professional will select from standard colors and finishes available.

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.

Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished 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.

Related sections include the following:

1. Division 3 section "Cast in Place Concrete" for surface preparation of exposed interior concrete finishes.
2. Division 5 section "Metal Fabrications" for shop priming ferrous metal.
3. Division 6 section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
4. Division 8 section "Steel Doors and Frames" for shop priming steel doors and frames.
5. Division 9 section "Gypsum Board Assemblies" for surface preparation for gypsum board.

1.03 Definitions

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

Samples for initial color selection in the form of manufacturer's color charts shall be submitted to the supervising professional for color selection. Field samples on various surfaces to be finished may be requested by the supervising professional.

Maintenance data for each product specified, to include in Operating and Maintenance Manual specified in Division 1.

1.05 Quality Assurance

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.

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

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.

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.

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

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).

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).

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.

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

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

Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, products listed in the paint schedules.

Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

1. Devoe & Raynolds Co. (Devoe).
2. Glidden Co. (The) (Glidden).
3. Benjamin Moore & Co. (Moore).
4. PPG Industries, Inc. (PPG).
5. Pratt & Lambert, Inc. (P & L).
6. Mautz Paint Co. Industrial Division
7. Sherwin-Williams Co. (S-W).

2.02 Paint Materials, General

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.

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.

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.

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

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.

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.

Notify the supervising professional about anticipated problems using the materials specified over substrates primed by others.

3.02 Preparation

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.

After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

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.

Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

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 re-prime.
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 non-petroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

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.

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

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.

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.

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.

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.

Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

Items to be painted include: Piping and accessory items.

Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

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.

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

Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

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

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 supervising professional.

Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

Paint plywood equipment boards in their entirety prior to the installation of equipment. Coordinate this work with other trades.

3.06 Exterior Paint Schedule

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) Devoe: 13101 Mirrolac Rust Penetrating Metal Primer.
        2) Glidden: 5205 Glid-Guard Tank and Structural Primer, Red.
        3) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
        4) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
        5) P & L: S 4551 Tech-Gard High Performance Rust-Inhibitor Primer.
        6) 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) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
    2) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
    3) Moore: Impervo Enamel #133.
    4) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.
    5) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
    6) S-W: Industrial Enamel B-54 Series.

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) Devoe: 8502/8520 Mirrolac-WB Interior/Exterior Waterborne Flat DTM Primer and Finish.
        2) Glidden: 5205 Glid-Guard Tank and Structural Primer, Red.
        3) Moore: IronClad Galvanized Metal Latex Primer #155.
        4) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
        5) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
        6) 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) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
        2) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
        3) Moore: Impervo Enamel #133.
        4) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.
        5) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
        6) S-W: Industrial Enamel B-54 Series.

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) Devoe: 8502/8520 Mirrolac-WB Interior/Exterior Waterborne Flat DTM Primer and Finish.
2) Glidden: 5205 Glid-Guard Tank and Structural Primer, Red.
3) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
4) PPG: 90-709 Pitt-Tech Primer.
5) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
6) 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) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
2) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
3) Moore: Impervo Enamel #133.
4) PPG: 6-282 Speedhide Interior/Exterior Gloss Oil Enamel.
5) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
6) S-W: Industrial Enamel B-54 Series.

3.07 Interior Paint Schedule

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) Devoe: 52902 Bloxfil 200 Interior/Exterior Latex Block Filler.
      2) Glidden: 5317 Ultra-Hide Block Filler, Latex Interior-Exterior.
      3) Moore: Moorcraft Interior and Exterior Block Filler #173.
      4) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
      5) P & L: Z 98 Pro-Hide Plus Latex Block Filler.
      6) 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) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
      2) Glidden: UH 400 Ultra-Hide Alkyd Interior Enamel Undercoater.
      3) Moore: Moore's Alkyd Enamel Underbody #217.
      4) PPG: 6-855 Speedhide Interior Latex Enamel Undercoater.
      5) P & L: S/D 1012 Suprime "12" Interior Alkyd Wall Primer.
      6) 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) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
2) Glidden: UH 8400 Ultra Traditional Alkyd Semi-Gloss Enamel.
3) Moore: Satin Impervo #235.
4) PPG: 27 Line Wallhide Low Odor Interior EnamelWall and Trim Semi-Gloss Oil.
5) P & L: S/D 5700 Series Cellu-Tone Alkyd Satin Enamel.
6) S-W: Promar 200 Alkyd Semi-Gloss

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) Devoe: 50801 Wonder-Tones Interior Vinyl Latex Primer-Sealer.
      2) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
      3) Moore: Regal First Coat Interior Latex Primer and Underbody #216.
      4) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
      5) P & L: Z/F 1004 Suprime "4" Interior Latex Wall Primer.
      6) 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) Devoe: 34XX Wonder-Tones Interior Latex Eggshell Enamel.
      2) Glidden: 4100 Series Spred Ultra Eggshell Latex Wall and Trim Paint.
      3) Moore: Moore's Regal AquaVelvet #319.
      4) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
      P & L: Z/F 4000 Series Accolade Interior Velvet.
      S-W: ProMar 200 Interior Latex Eg-Shel B20 Series

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) Devoe: None required.
      2) Glidden: Glidden Paste Wood Filler.
      3) Moore: Benwood Paste Wood Filler #238.
      4) PPG: None required.
      5) P & L: None required.
      6) S-W: Sher-Wood Natural Filler.
   b. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.

1) Devoe: 96XX WoodWorks Alkyd Interior Stain.
2) Glidden: 1600 Series Woodmaster Oil Wood Stain.
3) Moore: Benwood Penetrating Stain #234.
4) PPG: 77-302 Rez Interior Semi-Transparent Stain.
5) P & L: S-Series Tonetic Wood Stain.
6) S-W: Oil Stain A-49 Series.

c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
1) Devoe: 4900 WoodWorks Quick-Dry Clear Sealer.
2) Glidden: 5035 Ultra-Hide Quick-Dry Sanding Sealer, Clear.
3) Moore: Moore's Interior Wood Finishes Quick-Dry Sanding Sealer #413.
4) PPG: 77-30 Rez Interior Quick-Drying Sealer and Finish.
5) P & L: H-40 Sanding Sealer.
6) 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) Devoe: 4600 WoodWorks Alkyd Satin Varnish.
2) Glidden: 82 Satin Sheen Woodmaster Polyurethane Clear Finishes Varnish.
3) Moore: Benwood Satin Finish Varnish #404.
4) PPG: 77-7 Rez Varnish, Interior Satin Oil Clear.
5) P & L: H24 38 Clear Finish Gloss.
6) S-W: FastDry Oil Base Varnish, Gloss A66-300.

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) Devoe: 13101 Mirrolac Rust Penetrating Metal Primer.
2) Glidden: 5207 Glid-Guard Tank and Structural Primer,White.
3) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
4) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
5) P & L: S 4551 Tech-Gard High Performance Rust Inhibitor Primer.
6) 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) Devoe: 84XX Mirrolac-WB Interior-Exterior Waterborne High Gloss Enamel.
2) Fuller: 213-XX AA Enamel Interior Acrylic Latex High-Gloss Enamel.

3) Glidden: 6900 Series Lifemaster Pro Hi-Performance Acrylic Coating.
4) Moore: Impervex Enamel #309.
5) PPG: 51 Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel.
6) P & L: Z/F 4400 Series Accolade Interior High Gloss.
7) S-W: ProMar 200 Interior Latex Gloss Enamel B21W201.

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) Devoe: 13201 Mirrolac Galvanized Metal Primer.
      2) Glidden: 5207 Glid-Guard Tank and Structural Primer,White.
      3) Moore: IronClad Galvanized Metal Latex Primer #155.
      4) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
      5) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
      6) 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) Devoe: 84XX Mirrolac-WB Interior-Exterior Waterborne High Gloss Enamel.
      2) Glidden: 6900 Series Lifemaster Pro Hi-Performance Acrylic Coating.
      3) Moore: Impervex Enamel #309.
      4) PPG: 51 Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel.
      5) P & L: Z/F 4400 Series Accolade Interior High Gloss.
      6) S-W: Indistrial Enamel B54YZ37.
2. Color: For interior piperails, handrails, guardrails, and steel tube curbs at inspection pits, paint safety yellow.

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.

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

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

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 Pit.
3. Application of high-performance coating cove base to concrete masonry wall surfaces in Inspections 117.
4. Adhesive backed slip-resistant stair nosing treads at concrete stairs to inspection pits.

1.02 Related Sections:

Section 03 30 00 – Concrete
Section 04 20 00 – Unit Masonry

1.03 Submittals

Product Data: Submit manufacturer's product data, including physical properties, chemical resistance, surface preparation and application instructions.

Submit manufacturer's standard warranty and applicator's warranty.

Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

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- (100-mm-) square samples for each color and finish.

1.04 Quality Assurance

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.

Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

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, supervising professional, 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

Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

Store and handle materials in accordance to manufacturer's instructions.

Part 2 - Products

2.01 Manufacturers

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

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.

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.

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

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 supervising professional 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

High-friction, slip-resistant tape, 2-inch wide x 60 ft. rolls, safety yellow, coated on the backside with a pressure-sensitive adhesive covered by a removable protective liner.

Manufacturer:

1. 3M™ Safety-Walk™ 500 Series
2. Safe Way Traction Pressure sensitive traction tape
3. Wooster Products, Inc., Flex-Tred anti-slip tape
4. Approved equal

Part 3 - Execution

3.01 Examination

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.

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.

Notify supervising professional about anticipated problems before using the coatings specified over substrates primed by others.

3.02 Preparation

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.

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 contaminates from cleaning process will not fall on wet, newly coated surfaces.

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.

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.

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

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, convector 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.

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.

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.

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.

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.

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
Prep and clean concrete stair tread surfaces as recommended by tape manufacturer.

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.

Test all adhesive strips and replace sections that fail to adhere properly to concrete substrate.

3.05 Cleaning
Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from project site.

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
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 supervising professional, 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
Applicable provisions of Division 1 shall govern the work under this section.

Section includes;

1. Porcelain Enamel Markerboards
2. Vinyl-Fabric-Faced Tackboards

1.02 Related Work

Section 06 10 00 – Rough Carpentry: Wall backing

1.03 Submittals

Shop Drawings: Include sections of trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

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

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.
5. Approved equal

2.02 Material

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° F (649° 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.
    1) Core: 3/8-inch-thick particleboard, ANSI A208.1, Grade 1-M-1.
    2) Backing Sheet: 0.015-inch-thick aluminum sheet.
    3) Laminating Adhesive: Moisture-resistant thermoplastic adhesive.
    4) Mounting Method: Continuous top hanger strips with clips at bottom edge.

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 in accordance to ASTM E 84. Color as selected by architect from manufacturer's standard colors.

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.

Fabrication: Laminate porcelain enamel facing sheet and backing sheet to core material with flexible, waterproof adhesive.

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.

Finishes: Comply with NAAMM "Metal Finishes Manual."

Class II Clear Anodized Finish: AA-M12C22A31.

Part 3 - Execution

3.01 Installation
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, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

Install units in locations and mounting heights indicated in accordance 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.

Coordinate job-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.02 Markerboard Break-In:
Clean in accordance to manufacturer's instructions. Break-in markerboards only as recommended by the manufacturer.

End of Section 10 11 00

Section 10 12 00 – Map Display Cases

Part 1 - General

1.01 Scope of Work
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

Work includes:
1. Prefabricated aluminum map display cases.
2. Brochure display rack

1.02 Related Sections
Section 04 20 00 – Unit Masonry: Block walls

1.03 Submittals
Submit shop drawings, technical data sheets and schedules.

Submit corner sample of display case in specified color finish for approval.

Contract Closeout Submittals: Maintenance Data: manufacturer’s cleaning and maintenance instructions covering both routine and long-term operations.

1.04 References

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.

1.05 Delivery and Storage

Ship materials including attachment devices carefully packaged to prevent surface damage. Include shop drawings to ensure correct installation and arrangement of all materials.

1.03 Warranty

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

Map Display Cases

1. Poblocki Sign Company, West Allis, WI: Model 'B' Poster Case Series
2. Aarco Products, Inc.
3. Nelson-Harkins Industries
4. Apco
5. Approved equal

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. Equivalent products from the following manufacturers will be accepted contingent on compliance with the product basis listed above.
   a. Magzineracks.com
   b. Braeside Display
   c. Siegel Display Products
   d. Approved equal

2.02 Materials

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 I clear with minimum 0.25” (6 mm) thickness.
4. Tackable Surface: ¼” thick linoleum grade cork with burlap backing.

Wall Mounted Brochure Holder

1. The rack includes sis (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” wide x 20” high acrylic backplate.

2.03 Fabrication

Map Display Case Cabinet:

1. Description: 6030-T5 extruded aluminum alloy in accordance to ASTM B221; minimum 0.090” thick for window frame panels, and horizontal mullions. Aluminum extrusion nitered and assembled with concealed corner angles.
2. Cabinet Profile: 2” x ½” x 1/8” channel framed aluminum case. Cabinet depth to be 2 inches.
3. Glazing: Minimum ¼-inch clear tempered glass in accordance to Section 08 80 00.
4. Door Profiles:
   a. Vestibule 101: Top hinged aluminum frame with continuous anodized 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 108: 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.

Mounting Method: Surface mounted to concrete masonry wall surfaces behind.

Cabinet Background Finish: ¼-inch thick linoleum grade colored cork at background over ¼” luan plywood. Finish and color to be selected by architect from manufacturer’s standard options.

Frame Finish: Provide custom color acrylic polyurethane finish on all exposed framing in color to match aluminum curtain wall specified under Section 08 44 00.

2.03 Display Case Schedule (Indicated On Plans As ‘Dc’)

Mark	Location	Width	Height	Access Panel
DC-1	Vestibule 101	72”	48”	Top hinged w/ hold-opens
DC-2	Public Lobby 106	36”	44”	Side hinged
DC-3	Vestibule 101	23”	20”	

Part 3 – Execution

3.01 Installation
Install map cases in accordance to shop drawings and manufacturer's recommendations.

3.02 Cleaning, Protection and Repair
Clean display units of dirt, dust, and grease after installation.

Protect finished installation from damage from work of other trades, such as plastering, gypsum wallboard, painting, etc. Repair damaged work to satisfaction of architect or replace work at no additional expense to owner.

End of Section 10 12 00

Section 10 14 16 – Interior Room Signage

Part 1 – General

1.01 Scope of Work
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.

Work includes:
1. Interior room sign plaques
2. Die-cut vinyl letters and graphics
3. Dedication Plaque

1.02 References
ADA 101-336, Sections 4.30 – 4.30-5.

1.03 Submittals
Submit shop drawings indicating dimensions and text layout.

Room list with room names and numbers for review by architect.

Manufacturer's standard color list for selection by architect.

Sign plaque sample.

Part 2 – Products

2.01 Manufacturers

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.
11. Approved equal

2.02 Materials

Sign Frame: Square corner modular plastic molded frame, ½-inch deep, prepunched for screw mounting to wall substrate.

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-inch 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

Room Signs: Room name and number to be identified with 1-1/4-inch high 'Helvetica Medium' raised letters with corresponding Grade 2 Braille text.

1. Size: 8" x 8"

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-inch high lettering indicating 'DANGER CONFINED SPACE'.

2.04 Mounting Method

Signs to be furnished to the jobsite with factory applied double-face tape and pre-punched for mechanical attachment (min. 2 screws).

Part 3 – Execution

3.01 Installation

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.

All room signs shall be mounted at 60 inches above finished floor to centerline of the sign.

Apply die-cut vinyl lettering and graphics where directed by WisDOT personnel.

3.02 Room Plaque Sign Schedule

Qty.	Room Location	Room No.	Graphic/Text
1	Storage	102	Room Name and Room Number
1	Storage	103	Room Name and Room Number
1	Women's Toilet	104	Female Pictogram w/ Universal Accessibility Symbol
1	Men's Toilet	105	Male Pictogram w/ Universal Accessibility Symbol
1	Uni-Sex Toilet	106	Male/Female Pictogram w/ Universal Accessibility Symbol
1	Janitor	107	Room Name and Room Number
1	Office	113	Officer's Name / Room Number
1	Multi-purpose Room	114	Room Name and Room Number
1	Telecom	115	Room Name and Room Number
2	Mechanical Room	116	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

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

Work includes:

1. Individual cast aluminum lettered sign.
2. Cast aluminum numerals

1.02 Submittals

Product Data: Manufacturer's construction details.

Shop Drawings: Show plans and elevations, sections of typical members, anchors, reinforcement, layout and installation details. Include the following:

1. Message list for each sign; include wording and letter layout.
2. Setting drawings and templates for anchor bolt installation.
3. Full-size spacing templates for dimensional letters.

Samples for selection of color, pattern and surface texture. Show full range of colors available.

1. Aluminum: Each finish type and color.

Part 2 - Products

2.01 Manufacturers:

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
5. Approved equal

Aluminum Castings: Alloy and temper recommended for casting process used.

Fasteners: Concealed non-corrosive metal fasteners.

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.

Unframed panel signs: fabricate edges mechanically and smoothly finished as follows:

1. Corner Condition: Square.

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.

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.

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

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.

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.

Projected Mounting: Mount at distance indicated from wall surface.

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 in accordance 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 Resistence: Provide rigid vinyl that does not support fungal or bacterial growth as tested in accordance to ASTM G-21 and ASTM G-22.

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.
5. Approved equal

2.02 Materials

A. Snap-On Corner Guards (90 deg. and 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 mars and abrasions under impact. Extrusions shall securely snap over .070 aluminum retainer, mill finish yet retain shock-absorbing movement.

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 in accordance 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
Applicable provisions of Division 1 shall govern the work under this section.

Work Includes
1. Toilet room accessories
2. Janitor's Closet Accessories

1.02 Submittals
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.

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.

1.04 References
International Building Code

Americans with Disabilities Architectural Guidelines (ADA)

Part 2 - Products

2.01 Manufacturers
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
5. Approved equal

2.02 Materials
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 keys to owner's representative and obtain receipt.

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: 3

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 and inside face of bar.
3. Gripping Surfaces: Manufacturer’s standard nonslip texture.
4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.
5. Qty: See plans.

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: 3

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 ¾” return edges. Front edge shall be hemmed for safe handling.

2. Lengths
    a. Toilet Rooms 104, 105, 106; 16” wide x 5” deep
    b. Inspections 117: 36” wide x 5” deep

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: 3

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

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: 3

Surface-Mounted Soap Dispenser (Inspections 117)

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.

Surface Mounted Paper Towel Dispenser (Multi-Purpose Rm 114 and Inspections 117)

1. Manufacturers
   a. Bobrick Model B-72860
   b. Bradley Model 2495
   c. Tork Hand Towel Roll Dispenser, Lever Auto Transfer, Model 84TR
   d. Approved equal

2. Description: Surface-mounted towel dispenser with lever-operated dispensing mechanism will provide an adjustable means to dispense a nominal 2-1/2", 4" or 5" of toweling per stroke. Toweling will only be dispensed with the downward stroke of the lever. Unit shall accommodate one 8" wide paper towel roll and one 4" partial (stub) roll. 1-1/2" core diameter.

Mop / Broom Holder (Janitor's Room 107)

1. Mop and broom holder shall be ype-304 stainless steel with satin finish. Unit shall be 24" long with three spring-loaded rubber cam holders.

Stainless Steel Clothes Hooks (Multi-Purpose Rm. 114)

1. Bobrick Model B-672
2. Bradley Model 9124
3. Hook shall be polished stainless steel surface mount contoured robe hook with 4" wide horizontal bar that provides two hooks. 22-gauge stainless steel on a concealed 16-ga. mounting bracket.

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: 3

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 in accordance 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, in accordance 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
Applicable provisions of Division 1 shall govern the work under this section.

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
Section 04 20 00 – Concrete Unit Masonry: Preparation of openings

1.03 Submittals
Manufacturer’s product data

Shop drawings indicating wall-mounting conditions, opening requirements and installation accessories.

Part 2 -Products

2.01 Manufacturers
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.
6. Approved equal

2.02 Equipment
Fire Extinguishers: Provide fire extinguishers for each extinguisher cabinet and other locations indicated. Furnish matching units where shown in lockers or surface wall mounted. Extinguishers to be fully charged, tagged and dated.

Multipurpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10-lb. nominal capacity, in enameled steel container.

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.

Mounting Brackets: Provide brackets for extinguishers not located in cabinets.

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.

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.

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.

Identify bracket-mounted extinguishers with red letter decals spelling "fire extinguisher" applied to wall surface. Letter size, style, and location as selected by architect.

Door Style: Manufacturer's standard design.

1. Full-Glass Panel: 1/4-inch-thick clear acrylic.
    a. Silk screen lettering.

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.

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.

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).

Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturers standard 2-coat baked enamel finish, consisting of prime coat and thermosetting topcoat.

Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 2.0 mils.

Color and Gloss: As selected by architect from manufacturers standard choices for color and gloss.

Part 3 - Execution

3.01 Installation

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. Multi-tier evidence storage locker
   3. Provide fasteners and anchorage devices to install lockers provided under this section.
   4. Provide metal filler panels to fill between banks of lockers and adjacent construction.

1.03 Submittals

A. The following shall be submitted in accordance 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 manual specified in Division 1.

1.04 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 in accordance to manufacturer's instructions.

B. Body of Lockers
   1. Exterior sides, Tops, Bottoms, Tier Dividers and Fascia: 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.

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.

2.04 Locker Schedule

Symbol*	Location	Type	Size
LO-1	Corridor 112	Single-Tier	18" W x 18" D x 36" H
LO-2	Storage 103	Single-Tier	15" W x 15" D x 72" H
LO-3	Storage 103	5-Tier	15"W x 15"D x 72" H

Part 3 - Execution

3.01 Installation

A. Wall Installation

Securely anchor every locker to wall before use. Installation hardware to be determined based upon wall construction. Tie adjacent locker units by bolting at four points, two at top and two at bottom , using ¼ 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
Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

Section includes:
1. Safety net system for use in conjunction with the recessed floor inspection trenches in the Inspection Bays.

1.02 Related Sections
Section 05 50 00 – Metal Fabrications: Steel tube trolley assembly for safety netting attachment.

1.03 Submittals
Product data

Samples: Submit 36” long sample of netting complete with hemmed edge and grommets.

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
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
Deliver netting protected in waterproof wrapping and identified as “Inspection Bay Trench Netting”. Store in dry area.

Part 2 – Products

2.01 Manufacturer
BayNets Safety Systems, Colchester, CT 06415 (Ph: 800-331-0731): BayNets™ ‘BNS38 System’

2.02 Materials

Description: Provide two sets of bi-parting net systems.

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

Netting Components:

1. Provide quick-link connectors for attachment to steel tube trolley rails.

Part 3 – Execution

3.01 Preparation

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 Installation

Install per manufacturer's recommendations. Include all required clamps, hardware, cables, for a complete and functioning system.

Weld one cab-lug (cable attached) to the side wall of the bay in a horizontal position as high as possible. Weld one Cab-Lug (without cable) to the opposite end of the bay in a horizontal position. Repeat for opposite side of the bay.

Weld the mid-bay pad eyes to the side wall of the bay in-line with the corner cab-lugs. Space these evenly with no more than 15 feet between pad eyes. Attach a snap hook to each mid bay pad eye.

Unscrew both sides of turnbuckle to its limit, then attach the jaw end of the turnbuckle to the cab-lug (without cable). Repeat on each side.

Run the cab-lug attached cable assembly down the length of bay and through the mid-bay snap hooks. Repeat on each side. Place 3 cable clamps on the free end of the cable. Thread the cable through the turnbuckle, around the thimble and through the 3 cable clamps. Pull slack out of the wire and tighten one clamp to hold cable in place. Tighten and torque the three cable clamps to 45 ft-lb. Repeat with the other cable assembly.

Tighten each cable assembly at turnbuckle until the cable can be moved no more than 2 inches vertically at the midway point of the bay net.

Attach net to the cable using quick links along the two long sides every 15 inches on center. Use the aluminum rings on the net as a guide.

Install the largest snap hooks to each corner of the net.

Following installation, the entire safety net system should be checked for smooth operation. Adjust as necessary.

3.3 Demonstration
Train owner's designated personnel on procedures related to net operation, stowage, troubleshooting, servicing, and preventative maintenance.

Schedule training with owner with at least 7-day advance notice.

End of Section 10 60 00

Section 10 75 00 – Flagpoles

Part 1 – General

1.01 Scope of Work
Provide all materials, accessories and labor necessary for the installation of aluminum flagpoles as shown on the drawings.

1.02 Related Work (By Others)
Section 03 30 00 – Concrete Piers
Division 26 - Electrical Systems: Connection to pole mounted light fixtures.

1.03 Submittals
Manufacturer's product data and installation instructions.

Shop Drawings

Part 2 – Products

2.01 Materials
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.
8. Approved equal

2.02 Fabrication

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.

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

Cone Taper: Manufacturer's standard seamless, uniform, straight-line tapered section above a cylinder butt section.

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:

Finial ball, 8" aluminum w/gold anodized finish.

Interior stainless steel halyard, with plastic coated counterweight and sling.

Truck assembly, stainless steel, revolving, stainless steel ball bearings, non-fouling, finished to match pole.

Hand crank, removable type.

Flash collar, spun aluminum to match flagpole finish.

Light Fixtures: Bracket mounted 18" long x 6" diameter aluminum cylinders designed to accept 150 watt flood lamps for up lighting. Finish to match flagpole.

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: 5
2. State of Wisconsin flags

a. Size: 4’ x 6’
b. Qty: 5

Part 3 – Execution

1.01 Installation:

As shown, complete and in accordance to manufacturer’s instructions.

Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

Maximum variation from plumb: 1 inch.

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:

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

Work Includes

1. Motorized projection screens
2. Projector mounts
3. Flat screen monitor mounting frame

1.02 Related Work By Others

Division 26 – Electrical: Electrical supply for electric screens

1.03 Submittals: In addition to product data, submit the following:

Shop drawings showing screen dimensions, fabrication, installation details, and electric wiring details.

1.04 Quality Assurance

Motors for electric screens shall be certified by Underwriters Laboratory (UL), Inc. and shall bear UL label.

Part 2 - Products:

2.01 Projection Screens

Manual Pull-down Projection Screens

1. Manufacturers: For basis of design, the plans are based on the Da-Lite, Spiceland, IN: Advantage ® Manual with CSR.
   a. Equivalent products from the following manufacturers will be accepted.
      Draper
      Elite
2. Rollers: Provide rigid metal rollers with Controlled Screen Return to control the return speed of the screen surface back into the case.
3. Projection Screen
   a. Type: Manually operated, retractable projection screen.
      1) Installation method: Ceiling pocket mounted.
      2) Case: Top, front and back of case to be made of extruded aluminum. End caps to be of heavy gauge steel. Bottom of case to have removable access door. 3) Finish: White enamel paint.
      3) Permanently attach screen fabric to roller. Provide bottom of screen with metal rod in pocket.
      4) Viewing surface: Matte White
         a. Size: 4:3 ratio, 100” diagonal
         b. Provide with black masking borders.

2.02 Projector Mount

Manufacturers

1. Chief Model Security Mount #RPAA1
2. Peerless Model PMS Security Mount PSM UNV-W

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.

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

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:

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.

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

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-inch 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

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.

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 in accordance to manufacturer.

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

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:

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

Work Includes

1. Defibrillator equipment

1.02 Related Work By Others

Division 26 – Electrical: Electrical supply

1.03 Submittals:

Submit product literature and specifications.

Part 2 - Products:

2.01 Defibrillator Equipment

Manufacturer:

1. Philips Heart Start FRx
2. Medtronic Physio Control LifePak 9P
3. Approved equal

2.02 Description
Defibrillator to have EASY 1-2-3 operation with built-in noninvasive pacing and user-friendly display.

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
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
Furnish and install window treatment at all rooms identified on the drawings, including all track systems, and mounting hardware necessary for a complete installation.

Window treatment will include the following:
1. Horizontal louver window blinds
2. Rolling fabric room darkening solar shades
3. Roller tinted film shades

1.02 References
ASTM E84 – Surface Burning Characteristics of Building Materials

1.03 Submittals
Samples two 12 inch long samples illustrating color and pattern for each horizontal blind material specified.

Shop drawings showing details of components necessary for a complete installation.

Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

Maintenance Data: Include maintenance procedures. Recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.04 Warranty

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.

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

Horizontal Louver Blinds (WT-1)

1. Graber, Middleton, WI
2. Hunter Douglas
3. Levolor Contract
4. Springs Window Fashions Division; Bali
5. Verosol USA, Inc.
6. Approved equal

Rolling Fabric Solar Shades (WT-2)

1. BTX Window Automation, Inc.
2. Draper Shade and Screen Co., Inc.
3. MechoShade Systems, Inc.
4. Approved equal

Rolling Tinted Film Solar Shades (WT-3)

1. Hunter Douglas Window Fashions
2. Nyson Shading Systems Ltd.
3. Sol-R-Veil
4. Approved equal

2.02 Materials - Horizontal Louver Blinds: WT-1 (See Drawing A904)

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; long edges returned or rolled; fully enclosing operating mechanisms 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)
Provide vinyl-coated polyester yarns consisting of 25% polyester, 75% PVC on polyester with 0% openness factor equal to Phifer Sheerwearve Style 7000.

Solar Shade Colors
Selected by architect from manufacturer’s standard color range.

Roller Tube: 2-inch dia. heavy-duty aluminum tube.

Lift Operation: Manual, top-locking cord lock.

2.04 Materials - Roller Tinted Film Shades: WT-3 (See Drawing A904)
Shade Material: Tinted mylar film

Selected from manufacturer’s standard range of colors.

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.

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.

Mounting Brackets: Galvanized or zinc-plated steel.

Fascia: L-shaped, formed steel sheet or extruded aluminum, long edges returned or rolled; continuous panel concealing front and bottom of solar roller, brackets, and operating hardware and operators; removable design for access. Finish to match color of curtainwall framing.

Lift Operation: Manual, top-locking cord lock.

Part 3 – Execution

3.01 Examination
Complete field measurements prior to fabrication.

3.02 Installation
Mount track assembly a recommended by manufacturer.

Install blinds

Test operation of blinds.
End of Section 12 20 00

Section 12 48 16 – Floor Grids and Floor Mats

Part 1 — General

1.01 Work Included
Applicable provisions of Division 1 shall govern the work under this section.

Section Includes
1. Aluminum frames floor grid and mat
2. Anti-fatigue mats

1.02 Related Sections
Section 03 30 00 - Concrete

1.03 References
American Society for Testing and Materials (ASTM)

ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.04 Submittals
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.

Submit shop drawings showing layout and types of [mats] [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.

Submit one 12" x 12" sample of the specified system.

1.05 Delivery, Storage and Handling
Deliver [floor mat system] [floor grid system] to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.

Store components in original containers in a clean, dry location.

1.06 Warranty
Submit manufacturer's warranty that materials furnished will perform as specified for a period of not less than two years for floor grids and not less than three years for floor mats when installed in accordance to manufacturer's recommendations.

Part 2 — Products

2.01 Acceptable Manufacturers
Floor Grids (MAT-1)

1. Balco, Inc., Wichita, KS 67217: FGLP Series
2. Pawling Corp., Wassaic, NY
3. Construction Specialties
4. Approved equal

Anti-Fatigue Mats (MAT-2)

1. R.C. Musson Rubber Company: 'Sof-Spun Vinyl Sponge Mats'
2. 3M
3. Mats Inc. 'Cushion Eze'
4. Approved equal

2.02 Materials – Floor Grids

Floor Grid Systems:

1. Tread rails: ASTM B221, alloy 6005-T6.
2. Continuous vinyl hinges: Flexible P.V.C.
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.

Inserts: Two part epoxy combined with aluminum oxide grit.

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.

Color: Balco 'Earth Brown' or as selected from approved alternate manufacturers.

2.03 Materials – Anti-Fatigue Mats

3/8-inch thick closed cell sponge vinyl edge perimeter.

Surface: Embossed pebble surface.

Size (cut from roll goods)

Area	Size	Qty.
Operations 111	72" x 36"	2
Operations 111	36" x 36"	1

Color: Selected by architect from manufacturer's standard range of colors.

2.04 Fabrication – Floor Grids

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 be abrasive.
4. Fabricate abrasive treads of [one solid] [two parallel solid] line(s) of abrasive.
5. Provide necessary and related parts, devices, anchors and other items required for proper installation.

Provide components in single size where possible; minimize site splicing.

1. 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.
2. Frame, aluminum pan and I-beams shall be shop fabricated as an assembled unit for installation in the field.

Shop assemble components and package with anchors and fittings.

2.04 Finishes – Floor Grids

Aluminum

1. Tread rails, "U" channels: Clear Anodized
2. Embedded Frames: Shop coating of clear acrylic.

Abrasive: Specify color selected from standard abrasive colors.

2.05 Floor Grid Schedule

Room	**Size (Nominal Dimensions)**
Vestibule 101	14' – 0" long x 4'- 0" wide
Operations 111	3'- 0" long x 6'- 0" wide

Part 3 — Execution

3.01 Examination

Contractor shall verify that field measurements and recessed dimensions are as shown on shop drawings prior to releasing materials for fabrication by the manufacturer.

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

Install floor grid system in accordance to the governing regulations, the industry standards applicable to the work and the manufacturer's written installation instructions.

Work shall be aligned plumb, level, and, where required, flush with adjacent surfaces.

Carpet and Vinyl shall be positively locked into tread rails.

Anchors shall be spaced at 24 inches o.c.

3.03 Adjusting and Protection

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.

Advise the contractor of procedures required to protect the finished work from damage during the remainder of the construction period.

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, in accordance to the contract requirements.

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 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 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.
   1. Tables: Special T Tables
   2. Pedestals: Great Openings
   3. Task Chairs: 9 to 5 Seating
   4. Desks: Lacasse
   5. Bookcase: Lacasse

C. All products must have a minimum of a 15 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**: Not used

B. Tables: **F-2**
   1. Manufacturer: KI "Barron" Table - 60"W x 30"D x 29"H, 74P Edge, T-Base, HPL Surface and Powder-coated Base.
   2. Model: B255F-74P
   3. Quantity: 6
   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 11/8" 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**
Manufacturer: KI "700 Series" Pedestal – File/File Freestanding Pedestal File, 2 Drawer, Letter Size, Lockable and 24"D x 15"W x 29"H.

1. Model: S7P/1524FFF
2. Quantity: 13
3. 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 11/8" flanges on all edges, with the front edge having an additional return formation to further add strength. The front 11/8" 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 11/8" 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 11/4" 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 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, and 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 11/8" flanges on all edges, with the front edge having an additional return formation to further add strength. The front 11/8" 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 11/8" 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 11/4" 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 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.

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 and Height Adjustment.
2. Model: KI75/JR30
3. Quantity: 6

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 and Height Adjustment and Foot Rest Ring.
2. Model: KI74/JR30
3. Quantity: 6
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** and **F-7B**
1. 1. Manufacturer: KI "Grazie" - Stackable, 4-Leg w/Casters (F-7), Armless, Fully Upholstered Seat and Back w/Pallas Grade 1 Fabric. Perfect Pivot Back Mechanism. Substitute
2. (F-7) Model: GLNAUBC (Qty: 10), and Model GSNAP (Qty: 2)
3. Total Quantity: 10 (F-7), 2 (F-7B)
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 ½" 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 cross member. 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
   d. Approved equal
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
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.02 Summary
This section includes fixed seating with the following:

Floor mounted, molded-plastic stadium chairs (fixed audience seating).

1.03 Submittals
Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fixed audience seating.

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.

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.

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.

Maintenance Data: For fixed audience seating to include in maintenance manuals specified in Division 1. Include the following:

Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.

1.04 Quality Assurance
Installer Qualifications: Contractor with not less than five years of successful experience in installation of furnishing similar to those required for this project.

Source Limitations: Obtain each type of seating required, including accessories and mounting components, through one source from a single manufacturer.

1.05 Project Conditions

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.

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 Manufacturers

A. Wausau Tile, Wausau, WI; Site Furnishing Division
B. Custom Design Precast, Weston, WI
C. Petersen Manufacturing Co., Inc., Denison, IA
D. Approved equal

2.02 Site Furnishings Schedule

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.

B. Waste Container (Indicated as ‘SF-1’ on the ‘Fixture, Furniture And Equipment Plan, sheet A803.)
   1. Manufacturer: Wausau Tile Model ‘TF1029’
   2. Quantity: 3
   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.

C. Waste Container (Indicated as ‘SF-2’ on the ‘Fixture, Furniture And Equipment Plan, sheet A803.)
   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 Examination
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
Install seating in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions.

Install seating so moving components operate smoothly and quietly.

3.03 Adjusting
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
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.02 Summary
This section specifies general requirements for site furniture including the following:
1. Precast concrete waste containers
2. Precast concrete snuffers

1.03 Submittals
Product Data: Submit specifications, assembly, and installation instructions and general recommendations from manufacturers for each type of site furnishing required.

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
Manufacturer Qualifications: Manufacturer (material producer) with not less than five years of production of site furnishings similar to the items included under this section.

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

All shipping, storage and delivery costs for equipment furnished by the site furnishings supplier.

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

For basis of design, the plans are based on the site furnishing manufactured Wausau Tile, Wausau, WI; Site Furnishing Division.

Available Manufacturers

1. Wausau Tile, Wausau, WI; Site Furnishing Division
2. Custom Design Precast, Weston, WI
3. Petersen Manufacturing Co., Inc., Denison, IA
4. Approved equal

Equivalent products from alternate manufactures will be accepted contingent on compliance with specifications that meet or exceed the products specified in this section. Manufacturer's wishing to submit alternate products shall submit product data sheets and/or specifications.

2.02 Site Furnishings Schedule

Waste Container (Indicated as 'SF-1' on the 'Fixture, Furniture And Equipment Plan, sheet A803.)

1. Manufacturer: Wausau Tile Model 'TF1029'
2. Quantity: 3
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.

Waste Container (Indicated as 'SF-2' on the 'Fixture, Furniture And Equipment Plan, sheet A803.)

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
Set and level site furnishing equipment where indicated on the drawings.

3.02 Adjusting
Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

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 – Earthwork

Section 31 23 00 – Excavation and Fill

Part 1 – General

1.01 Scope of Work
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

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.

The work under this section includes:
1. Preparing subgrades for slabs-on-grade.
2. Excavating 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.

1.02 Related Sections

Section 03 30 00 - Cast-in-Place Concrete for fine-graded granular material under vapor retarder.

Division 22 and 26 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

Section 31 22 19 – Finish Grading

Section 33 46 16 – Subdrainage Systems

If rock is encountered, refer to the standard specifications for procedures.

1.03 References

Geotechnical Soils Report prepared by Soils & Engineering Services, Inc., Madison, WI and dated July 24, 2002.

1.04 Definitions

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.

Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by supervising professional. Additional excavation and replacement material will be paid for as Common Excavation per approval by supervising professional.
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 supervising professional. Unauthorized excavation, as well as remedial work directed by supervising professional, shall be without additional compensation.

Fill: Soil materials used to raise existing grades.

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.

Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

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

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 supervising professional for testing prior to performance of the work of this section.

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

Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548, and acceptable to the Wisconsin Department of Transportation.

1.07 Project Conditions

Existing Utilities: Do not interrupt utilities serving facilities occupied by owner or others unless permitted in writing by supervising professional and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify supervising professional not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without supervising professional's written permission.
3. Contact utility-locator service for area where project is located before excavating.

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

General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

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.

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.

Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

Compacted Granular Base: Drainage Course under vapor barrier below slabs-on grade, 6-inch minimum.

Backfill and Fill: Satisfactory soil materials.

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 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

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.

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.

Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

Geotextile: Artificial fabric used as a separation-type interface between proof-rolled native soil and subgrade fill.

2.02 Geotextile Fabric

Manufacturers

1. TenCate Geosynthetics North America; Mirafi® 500X
2. Geo-Synthetics, Inc., Waukesha, WI; Soiltex™ ST200W
3. Approved equal

Description: Geotextile fabric shall be composed of high-tenacity polypropylene woven yarns, resistant to naturally encountered chemicals, alkalis, and acids.

2.03 Accessories

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

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

Provide erosion control during the entire project as specified in standard specifications and elsewhere in the building specifications.

3.02 Protection of Excavation

Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding area.

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

Explosives: Do not use explosives.

3.04 Excavation, General

Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation 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

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, 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 to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb the bottom of excavations that are intended to be the bearing surface.

3.06 Excavation For Utility Trenches

Excavate trenches to indicated gradients, lines, depths, and elevations.

Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

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 (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

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 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

Notify supervising professional when excavations have reached required subgrade.

If supervising professional determines that unsatisfactory soil is present, continue excavation to a depth determined by the supervising professional and replace with compacted backfill or fill material as directed.

Additional excavation and replacement material will be paid as Common Excavation per approval by supervising professional.

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.

Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by supervising professional.

3.08 Unauthorized Excavation

Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by supervising professional.

Fill unauthorized excavations under other construction or utility pipe as directed by supervising professional.

3.09 Storage of Soil Materials

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.

Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 Geotextile Placement

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

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

Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings; fill with concrete to elevation of bottom of footings.

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.

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.

Coordinate backfilling with utilities testing.

Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

Place and compact final backfill of satisfactory soil material to final subgrade.

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

Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

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

Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent 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 and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 Compaction of Backfills and Fills

Place backfill and fill materials in layers not more than 12 inches (300 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 8 inches (200 mm) in loose depth for material compacted by hand-operated tampers.

Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs and steps, compact each layer of backfill, engineered fill, or fill material at 95 percent.

3.16 Grading

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.

Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

Refer to Section 30 22 19 – Finish Grading for finish grading outside of building lines.

3.17 Drainage Course

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 percent 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 or less than 3 inches (75 mm) thick when compacted.

3.18 Draintile

Install drainage pipe where indicated on the drawings. Refer to the structural and plumbing plans for details.

3.19 Field Quality Control

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.

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.

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 supervising professional.

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 2000 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.

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

Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

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.

Scarify or remove and replace soil material to depth as directed by supervising professional; reshape and recompact.

3.21 Disposal of Surplus and Waste Materials

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

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 supervising professional 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 so notified the supervising professional, 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

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

1.02 Summary

This section includes the following:

1. Factory finished hinge gates.

Related sections include the following:

1. Section 03 30 00 - Cast-in-place Concrete
2. Section 04 20 00 – Unit Masonry

1.03 Submittals

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.

Provide templates for anchors and bolts specified for installation under other sections.

Samples for Verification: Submit sample of rail – picket joint with specified finish.

1.04 Quality Assurance

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.

Welding: Qualify 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.

Provide welding complying with American Welding Society Structural Welding Code for Steel, AWS D1.1.

Comply with applicable portions of Pipe Railing Manual, current edition, National Association of Architectural Metal Manufacturers (NAAMM).

1.05 Project Conditions

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.

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

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

Deliver fabrications, materials including accessories, anchor bolts, setting and bearing plates to the site at such intervals to ensure uninterrupted progress of the work.

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

Ameristar® Fence Products, Tulsa, OK; Montage II, Approved equal

Approved equal

2.02 Materials

Steel material for gate panels and posts shall conform to the requirements of ASTM A653/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-inch square
2. Stair Guardrail Gate: 3-inch square

Material for pickets shall be 1-inch 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 inches o.c. Fence posts and gate posts shall meet the minimum requirements recommended by the manufacturer for project conditions.

2.03 Accessories

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 DSB200
    b. Stair Guardrail Gate: Single gate latch; Ameristar Model DSB300.

Expansion Type Anchors

1. Hilti Kwik Bolt II, 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

Pickets, rails and posts shall be precut to specified lengths. Rails shall be pre-punched to accept pickets.

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.

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 exceed the criteria of ASTM F2408.

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.

Swing gates shall be fabricated using 1.75" x 14-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

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.

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.

Gate posts shall be set plumb.

Install hardware as recommended by manufacturer.

End of Section 32 31 19

END OF DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – Utilities

Section 33 46 16 – Subdrainage Systems

Part 1 – General

1.01 Section Includes
Applicable provisions of Division 1 shall govern the work under this section.

Work Includes
1. Building perimeter foundation subdrainage system.
2. Filter aggregate
3. Filter fabric.

1.02 Products Furnished But Not Installed Under This Section
Section 03 30 00 – Concrete: Installation of pipe sleeves for routing through foundations.
Section 31 23 00 – Excavation and Fill: Utility Trench Backfill

1.03 Related Sections
Section 31 23 00 – Excavation and Fill: Excavating subsoil for sub drainage system piping.

1.04 References
ASTM D2729 – Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.

1.05 Submittals
Submit product data.

1.06 Project Record Documents
Accurately record location of pipe runs, connections, cleanouts and invert elevations.

Part 2 – Products

2.01 Pipe Materials

Polyvinyl Chloride Pipe: ASTM D2729;

1. Provide perforated, 4 inch inside diameter rigid piping at perimeter footing drain tile locations. Corrugated plastic tubing will not be accepted.
2. Provide 6-inch diameter rigid, non-perforated piping at locations indicated on the drawings for conducting subdrainage water from collection point in Inspections 117 to sump at tunnel to static scale.

2.02 Filter Aggregate

Coarse Filter Aggregate: Clean, well graded, natural gravel, crushed stone, free from shale, clay, organic, materials or debris.

Fine Filter Aggregate: Clean, natural sand; free from silt, clay, organic matter or soluble materials; graded within the following limits:

2.03 Accessories

Pipe Sleeve: Continuous perforated plastic.

Filter Fabric: Water previous type, black polyolefin.

Part 3 – Execution

3.01 Examination

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.

Beginning of installation means acceptance of existing conditions.

3.02 Preparation

Hand trim excavations to required elevations. Correct over excavation with fill material.

3.03 Installation

Install and join pipe and pipe fittings in accordance to manufacturers' instruction.

Lay pipe to slope gradients noted on drawings with minimum pitch of 1/16-inch per foot.

Install coarse filter aggregate at sides and over and top of pipe. Provide top cover compacted thickness of 12 inches.

Place filter fabric over leveled top surfaces of filter aggregate cover prior to subsequent backfilling operations.

Connect to precast concrete sump basin.

3.04 Protection
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

57. SWEF Building, General Construction, SPV.0105.14.

A Description
This item consists of the general construction work for the SWEF (Safety and Weight Enforcement Facility) building. The work shall be in accordance to the applicable plans and the following specifications.

Division 03 – Concrete
Division 04 – Masonry
Division 05 – Metals
Division 06 – Wood, Plastics, and Composites
Division 07 – Thermal and Moisture Protection
Division 08 – Openings
Division 09 – Finishes
Division 10 – Specialties
Division 11 – Equipment
Division 12 – Furnishings
Division 31 – Earthwork
Division 32 – Exterior Improvements
Division 33 – Utilities

B Measurement
SWEF Building, General Construction will be measured as a single unit complete in place and accepted.

C Payment
SWEF Building, General Construction, measured as provided above, will be paid for at the contract lump sum price, which price shall be 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

Part 1 - General

1.01 Work Included

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

B. Section Includes:

1. Formwork, shoring, bracing, and anchorage.
2. Concrete reinforcement, anchor bolts, waterstops and accessories.
3. Installation of perimeter and underslab insulation.
4. Granular base under slab-on-grade.
5. Underslab vapor retarder barrier.
6. Installation of subdrainage sleeves through footings and foundation walls.
6. Cast-in-place concrete.

1.02 Work Installed but Furnished Under Other Sections

Section 05 12 00 – Structural Steel: Anchor bolts
Section 07 21 13 – Board Insulation: Perimeter and underslab insulation

1.03 Related Sections

Section 05 12 00 – Structural Steel: Anchor Bolts.
Section 07 13 13 – Elastomeric Sheet Waterproofing.
Section 07 21 13 – Board Insulation: Perimeter insulation and protection board.
Division 22 - Plumbing
Division 23 – HVAC: In-Slab Radiant Heating
Division 26 – Electrical: In-slab and underslab conduits and electrical equipment.
Section 31 23 00 – Excavation and Fill
Section 32 13 13 – Concrete Sidewalks

1.04 References

ACI 301 – Specifications of Structural Concrete for Buildings
ANSI/ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement
ANSI/ASTM A497 – Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A615 – Deformed and Plain Billet-Steel for Concrete Reinforcement
ASTM C 33 - Concrete Aggregates
ASTM C94 – Ready-Mixed Concrete
ASTM C150 – Portland Cement
ASTM C260 – Air Entraining Admixtures for Concrete
ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete
FS TT-C-800 0 Curing Compound, Concrete, for New and Existing Surfaces

1.05 Submittals

Product data for fiber reinforcement**,** forming accessories, admixtures, patching compounds, waterstop vapor barrier, expansion joint filler, curing compounds, dry-shake finish materials, and others as requested by the architect.

Shop drawings for fabricating, bending, and placing concrete reinforcement and supports; type, size and location of all accessories (bar schedules, stirrup spacing, and diagrams of bent bars, arrangements and accessories), bar laps on strings of horizontal bars (all lap splices shall develop full strength of bar unless lesser laps permitted by drawings), manufacturers specifications and installation instructions for splice devices. Comply with ACI 318 Manual of Standard Practice for Detailing Reinforced Concrete Structures.

Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement.

Welding Certificates: Copies of certificates for welding procedures and personnel.

Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials.

Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Vapor retarders.
5. Curing materials.

1.06 Quality Assurance:

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.

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

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.

The general contractor shall employ a separate testing laboratory to evaluate concrete delivered to and placed at site.

1.07 Testing and Quality Control Services

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 in accordance to requirements of the Contract Documents.

Quality Assurance

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

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.

Laboratory Responsibilities

Perform sampling and testing of concrete work as described under spec Section 03 30 00–Cast-In-Place Concrete, Art.3.09 – Field Quality Control.

1.08 Delivery, Storage, and Handling

Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.
2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963/D 3963M.

Part 2 - Products

2.01 Form Materials:

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.

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 factory treated with chemically reactive release agent and factory sealed edge sealant.

Manufacturers

a. Simpson B-Matte® 333
b. Fourply, Inc. MOO 333
c. Royal Plywood Co. PacForm MDO™
d. Approved equal

Formed Surfaces Concealed From View
Wood: Clean straight lumber dressed on face and edges, nominal 1" thickness or plywood 5/8" or ¾" thick conforming to EXT-DFPA or metal forms smooth and as large size as possible.

Form Ties

1. For Unexposed Concrete: Adjustable length removable or snap-off type fabricated to leave holes no larger than 1-inch in diameter in face of concrete with breakpoint 1-inch or more from surface.
2. For Exposed Concrete: Snap-off type (break point 1 inch 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.

PVC Sleeves: Where indicated on the plans, furnish and install PVC sleeves through footings and foundations for routing of PVC subdrainage system per Section 33 46 16.

2.02 Granular Base Under Slab-On-Grades
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
Clean, free of loose rust, mill scale, dirt, ice, etc., as follows:

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

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

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.

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

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

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

2.04 Reinforcement Accessories

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 of CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

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.

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

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

Portland Cement: ASTM C 150, Type 1.

Fly Ash: Class C, ASTM 618.

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).

Steel and Synthetic Fiber Reinforcement: Steel and synthetic fibers engineered and designed for use in composite floor slabs, complying with ASTM C-1116, Type 1 at a minimum dosage rate of 25 lbs./cu. yd. and possessing an average residual strength of at least 92 psi, when tested in accordance to ASTM C 1399.

1. Products: Approved products are limited to the following:
    a. Novomesh 850 HHP Fibers; SI Concrete Systems.
    b. Dramix Duo 150; Bekaert Corporation
    c. Approved equal

2.06 Admixtures:

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
    e. Approved equal
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
    d. Approved equal
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
    e. Approved equal
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
    d. Approved equal
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
    e. Approved equal
6. Viscosity Modifying Admixture
    a. Polychem VMA, General Resource Technology, Inc., Eagan, MN
    b. Approved equal
7. Xypex C-500, XYPEX Chemical Corp.
    a. Applicable to the following below-grade foundation walls:
        Scale Tunnel 001, Stair 002, Recessed Inspection Pits 117A and 117B

2.07 Related Materials

Expansion Joint Filler

1. Flexible, lightweight, nonstaining, 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 where slabs abut walls, columns, or other vertical surfaces.
4. Manufacturer: W.R. Meadows 'Deck-O-Foam'

Waterstop

1. Provide 4" wide x 3/16" thick flat ribbed flexible PVC (polyvinyl chloride) waterstop equal to Greenstreak Style No. 781 or equivalent profile as manufactured by BoMetals, Inc.; Powder Springs, GA.
2. 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.
3. Performance Requirements as follows:

Property	Test Method	Required Limits
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lb/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 ±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

4. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
5. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.

Vapor Retarder

1. 15-mil sheet type plastic membrane meeting all requirements of ASTM E1745 Classes A, B and 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. Approved equal

Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

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 days. Add moisture daily to maintain surface in a damp condition.

Membrane-Forming Curing Compound: ASTM C 309, Type I Class A. Provide 2 coats. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 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. Cure and Hard, Symons Corporation
    b. Kure-N-Seal, Sonneborn-Chemrex
    c. Dayton J-20 Day-Chem Cure and Seal
    d. TK Products AS-1 Achro Seal 1315
    e. Approved equal

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 and Seal
    d. Approved equal

Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Dayton J-74 Sure-Film
2. Pre-approved equals

Sealer: Where sealer ("sealed slab") is noted on Room Finish Schedule. Apply per Manufacturer's instructions and at manufacturers recommended application rates. Provide manufacturer/s five year guarantee against dusting.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Lapidolith - Sonneborn Chemrex.
   b. Fluohard - L & M Construction Chemicals.
   c. Dayton J-15 Dry-Chem Hardener
   d. Son-No-Mar VOC, Light Gray - Sonneborn Chemrex
   d. Approved equal

Pipe Sleeves: Schedule 40 PVC piping

2.08 Mix Proportioning
Ready-Mix Concrete: Measure, mixed and delivered in accordance to ASTM C 94.

Mix Design Schedule:

Use	Min. Compress. Strength @ 28 days	Slump (Before Plasticzer)	Max Aggr Size	Min lbs of cement per C.Y.	Air Entran. %+/- 1/2%	W/C Ratio
Footings	3,000 PSI	5"	1 ½"	423 lb.	4.5%	.68
Walls/Piers	4,000 PSI	4"	¾"	541 lb	None	.57
Interior Office Slab-On-Grade	4,000 PSI	3"	1 ½"	541 lb	None	.57
Interior Traffic Slab-On-Grade	4,000 PSI	3"	1 ½"	541lb	6.0 %	.45
Exterior Slab-On-Grade	3,500 PSI	3"	¾"	517 lb.	6.0 %	.48
Bond Beams	3,000 PSI	4"	3/8"	517 lb.	None	.68

Air entrained concrete: Use for all exterior walls, exterior slabs, walks, platforms, ramps, steps and all other concrete exposed to freezing and thawing.

Revise sample figures below (from aci 318) to suit project. Delete types not required. If using a concrete schedule for strengths above 4000 psi, establish proportions based on ACI 318--section 4.3.

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 ½ inch.
2. Concrete without admixtures: 5 inch slump plus or minus 1 ½ inch and minus 1 inch.
3. Concrete containing high-range water-reducing admixture (super plasticizer): Not more than 8 inches plus or minus 1 ½ inches.

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.

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.

Use water-reducing, accelerating, and retarding admixtures that have been tested and accepted in mix designs in strict compliance with manufacturer's directions.

Job-Site Mixing: Use drum-type batch machine mixer, mixing not less than 1-1/2 minutes for 1 CY or smaller capacity. Increase mixing time at least 15 seconds for each additional CY.

Add fibrous concrete reinforcement to concrete materials at the time concrete is batched, in amounts in accordance to approved submittals for each type of concrete required. Mix concrete in strict accordance with fiber reinforcement manufacturer’s instructions and recommendations for uniform and complete distribution.

Part 3 - Execution

3.01 Formwork

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

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.

Install welded wire fabric in lengths as long as practicable; lap at least one full mesh and lace splices with wire.

3.03 Joints

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

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 Installation of Pipe Sleeves

The Concrete contractor shall install PVC pipe sleeves through foundation walls and footings where indicated on the drawings for plumbing lines and drain tile piping. Set pipe sleeves through formwork. Confirm exact elevations of plumbing lines with plumbing contractor.

3.06 Concrete Placement:

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.
        2) Protect adjacent finished materials/surfaces from concreting operations. Repair/replace any damaged surfaces/materials at no cost to owner.

3.07 Concrete Slab Flatness and Levelness Tolerances

Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed ¼-inch.

Concrete floor slabs surrounding floor drains shall be sloped ¼-inch per foot from "finished floor elevation" unless noted otherwise.

3.08 Finish of Formed Surface

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.

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. 3.08 above. Grind smooth surface defects that would telegraph through applied floor covering system.

Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.09 Curing / Sealing

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.

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.

3.10 Field Quality Control

Coordinate sampling and testing during concrete placement by General Building Contractor's independent testing agency as follows:

Site Testing

1. Testing firm will take cylinders and perform slump and air entrainment tests in accordance 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.

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

Section Includes:

1. Precast concrete hollow core plant.
2. Connections and bearing strips.
3. Grouted precast plank joints.
4. Precast concrete wall coping.

1.02 Related Sections

Section 04 05 13 – Masonry Mortar and Grout
Section 04 20 00 – Unit Masonry.
Section 07 92 00 - Sealants

1.03 References

Reference Specifications: Comply with recommended practices and procedures of the referenced specification standards and with the modification as specified herein.

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.

American Concrete Institute (ACI):

1. ACI 318-building Code Requirements for Reinforced Concrete.
2. ACI 301-Specifications for Structural Concrete Buildings.

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 and Performance Qualifications

1.04 Submittals

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.

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.

State Submittals: Provide six 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 of $300 made out to 'Wisconsin Dept. of Safety and Professional Services'.

Fabricator's Installation Instruction: Indicate special procedures required for installation and or temporary shoring requirements

1.05 Design Requirements

Design Standards: Comply with ACI 318-Building Code Requirements for Reinforced Concrete and MNL- 126 Manual for Design of Hollow Core Slabs.

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 ¼ inch of the camber indicated on the approved shop drawings.

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

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

Fabricator Qualifications: A qualified fabricator firm shall participate in PCL's Plant Certification program and is designated a PCI plant for Group C, Category CI. Approved fabricators included but are not limited to the following:

4. County Concrete
5. Spancrete Industries, Inc.
6. Mid-States Concrete Industries, Inc.

2.02 Materials

Form Materials: Provide formwork of sufficient strength to withstand pressures due to concrete operations and, when prestressed, pre-tensioning and de-tensioning 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.

Provide formed openings in precast units for holes larger than 10 inches in diameter.

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 250 unless otherwise indicated.
5. Steel Inserts and Connections: ASTM A 36, galvanized after fabrication where exposed to weather.

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.

Air-Entraining Admixture: ASTM C 260.

Water-Reducing Admixture: ASTM C 494, type as required.

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.

Produce standard-weight concrete consisting of Portland cement, aggregates, admixtures, and water to produce the following properties.

Compressive strength not less than 5000 psi at 28 days. Total air content not less than 4 percent nor more than 6 percent.

Color Additive (Precast Concrete Wall Coping): Bayferox inorganic, synthetic iron oxide pigments, lime proof and non-fading, conforming to ASTM C-979. Amount of pigment shall not exceed 10% by weight of the cement used.

2.03 Fabrication – Precast Hollow Core Plank

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.

Concrete Placement: Comply with PCI MNL 116.

Place concrete in continuous operation to prevent formation of seams or planes of weakness in precast units, using internal and external vibration for consolidation.

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.

Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.

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.

Cure precast units by low-pressure stream, steam vapor, radiant heat and moisture, or other similar process.

Delay de-tensioning of prestressed units until concrete has attained at least 75 percent of design ultimate compressive strength.

2.04 Fabrication – Cast Concrete Wall Coping
Provide precast wall coping in profile and lengths indicated on the drawings.

Aggregate:

1. Course Aggregate: Carefully graded and washed gravel or stone conforming to ASTM C-33, 3/8" maximum size.
2. Fine Aggregate: Carefully graded and washed natural concrete sand conforming to ASTM C-33.

Finish: Smooth
Color: Match color of CMU #4 specified under Section 04 20 00.

Part 3 – Execution
3.01 Preparation
Prepare support devices for the erection procedure and temporary bracing.

3.02 Erection – Precast Hollow Core Plank
Erection: Do not erect precast units until concrete has attained its design ultimate compressive strength.

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.

Provide necessary bolts, clips, hangers, and other accessories required for installation of precast units, galvanized after fabrication.

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.

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.

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 and Grout

Part 1 - General

1.01 Summary

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

Section Includes:

1. Preblended mortar
2. Preblended grout mixes.
3. Non-shrink grout

1.02 Related Sections

Section 04 20 00 – Concrete Unit Masonry
Section 05 50 00 – Metal Fabrications
Section 08 11 13 – Hollow Metal Doors and Frames

1.03 References

Preblended Mortars

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 C476 Standard Specification for Grout for Masonry.
7. ASTM C595 Standard Specification for Blended Hydraulic Cements.
8. ASTM C780 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. ASTM C926 Standard Specification for Application of Portland Cement-Based Plaster.
10. ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete.
11. ASTM C1329 Standard Specification for Mortar Cement.

Preblended 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

Non-Shrink Grout:

1. ASTM C 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
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 or Hydraulic Cement Mortar.
6. ASTM C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency.

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

Design and Performance Requirements: Provide mortar and grout mixes which have been selected, manufactured, mixed and installed to comply with the standards referenced herein.

1.05 Submittals

Product Data: Submit manufacturer's product data and installation instructions.

Samples: Submit two samples of selected mortar color.

1.06 Delivery, Storage and Handling

Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

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 of 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

Environmental Requirements:

1. Do not build or apply mortar products on frozen substrates. 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 Preblended Mortar Mixes and Grout Mixes

Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction.

Hydrated Lime: ASTM C207, Type S.

Mortar Cement: ASTM C 1329.

Masonry Cement: ASTM C 91.

Aggregate for Mortar: ASTM C 144, Fine Type, except for joints less than ¼ inch use aggregates graded with 100 percent passing a No. 16 sieve.

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.

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

Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Provide standard gray mortar at masonry walls of standard gray CMU.
2. Provide colored mortar to match colored masonry units.

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.

Grout Compressive Strength: Grout shall have minimum compressive strength of 3000 psi at 28 days when proportion in accordance to ASTM C 1019.

Grout Slump: The grout shall be mixed to a slump of 8 to 11 inches as determined by ASTM C 143/C 143M.

Non-Shrink Grout: ASTM C1107.

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’
    c. Approved equal

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.

Water: Potable.

Part 3 - Execution

3.01 Manufacturer's Instructions

Comply with the instructions and recommendations of the mortar and grout manufacturer.

3.02 Examination

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.

3.03 Mortar Mixing

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 who will outline hand-mixing procedures.

Observe mixing times of 4-5 minutes, consistent from batch to batch.

Use clean, potable water, add the maximum amount consistent with optimum workability.

Maintain a uniform water/cement ratio.

Rinse out mixer following each batch.

At the end of the day, thoroughly rinse the mixer to avoid contamination of future mortar batches.

Retemper mortar by adding mixing water only to replace water lost due to evaporation.

Do not retemper colored mortars.

Discard mortar 2.5 hours after initial mixing.

3.04 Installation

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 Profile: Concave unless noted otherwise.
5. Cure mortar a minimum of 28 days.

Grout:

1. Install grout in accordance to manufacturer's instructions.
2. Work grout into masonry cores and cavities to eliminate voids.
3. Grout hollow metal door and borrowed light frames where installed in masonry openings.
4. For masonry core fill grout applications, comply with the requirements of ASTM C926.

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

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.

End of Section 04 05 13

Section 04 20 00 - Unit Masonry

Part 1 – General

1.01 Scope of Work

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

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

Section 03 41 00 – Precast Concrete
Section 04 05 13 – Masonry Mortar and Grout
Section 05 50 00 – Metal Fabrications: Loose Steel Lintels
Section 07 21 19 – Foamed Masonry Core Fill
Section 08 11 13 – Metal Doors and Frames: Door frames set in masonry openings.

1.03 References

Unit Masonry Standard: ACI 530-05/ASSCE 50-5/TMS 402/05 Building Code Requirements for Masonry Structures and ACI 530.1 -05 /ASCE 6-05/TMS 602/05 Specifications for Masonry Structures.

1.04 Submittals:

General: Submit each item in this article according to the conditions of the contract and division 1 specification sections.

Product Data: For each different masonry unit, accessories, integral mortar water repellant and other manufactured product specified.

Samples for selection of the following:

1. Full-sized unit masonry samples showing the full range of colors and textures available for each different exposed masonry unit required.
2. Colored masonry mortar samples showing the full range of colors available.
3. Weep holes/vents.
4. Through-wall flashing.

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.

Material certificates for the following, signed by manufacturer and contractor, certifying that each material complies with requirements.

1. Each different cement product required for motor and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
2. Each material and grade indicated for reinforcing bars.
3. Each type and size of joint reinforcement.
4. Each type and size of anchors, ties, and metal accessories.

Material test reports from a qualified independent testing agency, employed and paid by contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:

1. Mortar complying with property requirements of ASTM C 270
2. Mortar complying with BIA M1.
3. Grout mixes. Include description of type and proportions of grout ingredients.
4. Masonry units.

1.05 Fire Performance Characteristics

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

Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.

1. For Concrete Unit Masonry: As follows based on net area:
   a. f'm = 2,000 psi.

1.07 Quality Assurance

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.

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 8 feet long by 12 feet high by full thickness, including face and backup wythes as well as accessories.

   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.

Testing Agency Services: Sample and test in accordance 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.

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

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.

Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.

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.

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.

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.

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

A. County Materials., Eau Claire, WI
B. Premier Block Corporation, Eau Claire, WI
C. Anchor Block, Minnetonka, MN
D. Trenwyth Industries, Inc.
E. Approved equal

2.02 Materials – Concrete Masonry

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. 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.

Ground Face Concrete Masonry Units (GFCMU)

1. "Ultra" Burnished Masonry Units as manufactured by Premier Block Corporation, Eau Claire, WI. All units shall conform to ASTM C90-00 moisture controlled and shall have a high density polished groundface 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 byt e burnished masonry manufacturer.
    a. Application: Single coat, spray apply, 6 mil WFT (2mil DFT). Application shall be conducted in the presence of block manufacturer's representative.

Schedule of CMU Exposed Faces:

Mark	Face Texture	Nom.Face Size (ht.x width)	Color*	Bond Pattern
CMU-1	Smooth Face	8" x 16" and 4" x 16"	Standard Gray	Stacked Bond
CMU-2	Single Sided Ground Face CMU w/Single Score	8" x 16"	'Antique White'	Stacked Bond
CMU-3	Single Sided Ground Face CMU w/o Score	8" x 16" and 4" x 16"	'Antique White'	Stacked Bond
CMU-3A	Double Sides Ground Face CMU w/o Score	8" x 16"	'Antique White'	Stacked 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 CMU as manufactured by Premier Block.)

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 and Grout

2.04 Reinforcing Steel:
Steel Reinforcing Bars: Grade 60, Billet steel complying with ASTM A 615 (ASTM A 615M).

2.05 Joint Reinforcement
General: Provide joint reinforcement formed from the following:

Galvanized carbon-steel wire, ASTM A 153, Class B-2, hot-dipped galvanized at interior and exterior walls.

Manufacturers
1. Hohmann & Barnard, Hauppauge, NY
2. Heckman Building Products, Inc., Melrose Park, IL
3. Wire-Bond, Memphis, TN
4. Approved equal

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).

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.

For multi-wythe masonry cavity wall assemblies, provide ladder design with eyehooks 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
Description: 1-1/2-inch wide, hot-dipped galvanized corrugated buck anchors with 1-1/2-inch long standard bend and 5/16-inch predrilled holes.

Manufacturers

1. Hohmann & Barnard, Inc. Model #345 Corrugated Buck Anchor
2. Heckman Building Products Model #187
3. Approved equal

2.07 Adjustable Anchors For Connecting To Steel Frame

General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resists tension and compressive forces perpendicular to plane of wall. Assemblies shall consist of 11-gauge hot-dipped galvanized steel channel with 12-gauge hot-dipped galvanized wire anchors to fit within channel.

Manufacturer

1. Hohmann & Barnard, Inc. Hauppauge, NY.
2. Heckman Building Products, Inc. Melrose Park, IL.
3. Wire-Bond, Memphis, TN.
4. Approved equal

2.08 Miscellaneous Anchors

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.

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.

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

Composite Membrane Through-wall Flashing (See drawings for type/locations):

1. Manufacturers
   a. Carlisle Coatings & Waterproofing, Inc., Wylie, TX: ‘CCW-705-TWF’
   b. W.R. Grace & Co., Cambridge, MA: ‘Perm-A-Barrier’
   c. W.R. Meadows, Inc., Hampshire, IL: ‘Air-Shield’
   d. Approved equal
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.

Metal Flashings
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 Masonry Drainage And Ventilation System (Single-Wythe Masonry)
At single-wythe exterior masonry walls, provide plastic flashing-pans made from high-density recycled polypropylene with built-in weep spouts.

Manufacturer: Blok-Flash® by Mortar Net USA, Ltd., or approved equal.

2.11 Weep Vents
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.
2. Manufacturer:
    1. Archovations, Inc. *'CavClear Weep Vents'*
    2. Mortar Net® USA Ltd.
    3. Sandel Construction Solutions
    4. Approved equal

2.12 Cavity Wall Insulation
Where indicated on the drawings, provide rigid cavity wall insulation as follows;

1. Insulation Type: Closed cell polyisocyanurate rigid foam with acrylic coated aluminum foil facer per ASTM V1289, Type 1, Class 1. NFPA tested for exterior wall assembly specified.
2. Thickness: As shown on drawings
3. R-Value (Aged), ASTM C518: 6.5 per inch
4. Compressive Strength (ASTM D1621): 25 psi
5. Water Absorption (ASTM C272): <0.1% by volume
6. Flame Spread (E84): <25
7. Smoke Developed (E84): <450

Manufacturers

1. Atlas Wall CI Board – EnergyShield®PRO
2. Hunter Panels Xci 286 Foil Faced
3. Firestone Building Products Enverge™CI Foil
4. Approved equal

2.13 Accessories

Manufacturers:

1. Hohmann & Barnard, Inc. 'Mortar Net'
2. Archovations, Inc. 'CavClear Masonry Mat'
3. Sandel Construction Solutions
4. Approved equal

Mortar/Grout Screen: ¼" 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.

Mesh Type Mortar Stop

1. 1-inch high density polyethylene
2. Manufacturers:
   a. Hohman & Barnard, Inc. 'Mortar Net'
   b. Archovations, Inc. 'CavClear Masonry Mat'
   c. Approved equal

Closed Cell Neoprene Sponge

2. 3-inch wide x ½-inch thick sponge strips conforming to ASTM D-1056 Grade 2A1 with adhesive backing.
2. For use at vertical expansion/control joints in masonry veneer.
3. Manufacturer: Hohmann & Barnard, Inc. *Series #NS*

2.14 Sand Filled Cores

Where indicated on the drawings, fill CMU cores with clean masons sand.

2.15 Date Stone

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.

Cut Stone Source Options

1. Indiana Limestone, smooth finish, cut to profiles shown.
2. Winona Dolomite limestone as detailed, Biesanz Stone Co., Winona, MN
3. Anamosa Limestone, Weber Stone Co., Anamosa, IA
4. Approved equal

Color: Light Buff (submit sample)

2.16 Masonry Cleaners

Manufacturers:

1. Prosoco, Inc. *Sure Klean 600* Detergent
2. Diedrich Technologies 222
3. Chemical Products Industries, Inc.
4. Approved equal

Application must receive prior approval from concrete block manufacturer.

Part 3 - Execution

3.01 Examination

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.

Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.02 Pre-Installation Conference

At least two weeks before the start of above-grade masonry work, 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 contractor, Mason contractor, Flashing Installer, CMU Producer and/or the manufacturer of the CMU/Mortar Integral Water-Repellent Admixture. Advise the supervising professional of the scheduled meeting date.

3.03 Installation, General

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.

Build chases and recesses to accommodate items specified in this and other sections of the specifications.

Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to the opening.

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.

Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

Glass unit masonry components shall be installed as a component of concrete masonry unit wall assemblies as detailed using identical mortar and continuous wall reinforcing as specified.

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

Variation from Plumb: For vertical lines and surfaces of columns, walls, and arises, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), nor 3/8 inch in 20 feet (10 mm in 6 m), nor ½ inch in 40 feet (12 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor ½ inch in 40 feet (12 mm in 12 m) or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

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.

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 ¾ inch in 40 feet (19 mm in 12 m) or more.

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).

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

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.

Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

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.

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.

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.

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.

Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

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.

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.

Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above and as follows:

Install compressible filler in joint between top of partition and underside of structure above.

3.06 Installation – Mortar and Grout

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 Profile: Concave unless noted otherwise.
5. Cure mortar a minimum of 28 days.

6. 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.'
7. Mortar Joint Profiles shall be revised to read as follows:
8. Mortar Joint Profiles
    a. Exterior Masonry: Concave
    b. Interior Ground Face CMU: Raked joint
    c. Standard gray CMU: Concave

Grout:

1. Install grout in accordance 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.

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.

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.

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

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 8-inches o.c. vertically for all stacked bond CMU.

3.08 Adjustable Veneer Ties

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 ¼-inches.

3.09 Weeps and Vents

Install weep holes in veneer at 24 inches on center horizontally above through wall flashing at bottom of walls.

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
Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes.

Build outer wythe to permit installation of cavity insulation and air/vapor barrier adhesive.

3.11 Masonry Flashings
Extend flashings under veneer, turn up minimum (8) inches seal to sheathing over wood stud back-up.

Lap end joints minimum 6inches and seal watertight.

Use flashing manufacturer's recommended adhesive and sealer.

3.12 Control and Expansion Joints
Do not continue horizontal joint reinforcement through control and expansion joints.

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
Protect top of masonry walls daily.

3.14 Final Cleaning:
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.

1.2 Related Sections

A. Section 04 05 13 – Masonry Mortar and Grout
B. Section 04 20 00 – Unit Masonry
C. Section 07 92 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 C33-Standard Specification for Concrete Aggregates
D. ASTM C 150 – Standard Specification for Portland Cement
E. ASTM C 173 – Standard Test Method for Air Content of Freshly Mixed Concrete
F. ASTM C 1194 – Standard Test Method for Compressive Strength of Architectural Cast Stone
G. ASTM C 1195 – Standard Test Method for Absorption of Architectural Cast Stone
H. ASTM C 1364 – Standard Specification for Architectural Cast Stone
I. ASTM C 2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
J. 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.
B. Wet Cast Concrete Products – manufactured from measurable slump concrete.
C. Wet casting method: manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.5 Submittals: Comply with Section 01 33 00 – Submittal Procedures.

A. 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.
B. 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.

1.6 Quality Assurance

A. Standards: Comply with the requirements of the Cast Stone Institute® Technical Manual and the project specifications.

Part 2 – Products

2.1 Manufacturers

A. American Artstone Company, New Ulm, MN
B. MidCon Products, Inc., Hortonville, WI;
C. Architectural Cast Stone, Inc., Wichita, KS
D. Approved equal

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. Water – Potable
F. 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.

G. 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 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.

2.4 Reinforcing

A. Minimum reinforcing shall be 0.25 percent of the cross section area.
B. 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.

2.5 Manufacturing Tolerances

A. Cross section dimensions shall not deviate by more than ±1/8 in, whichever is greater, not to exceed ±1/4 in.
B. 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.

Part 3 - Execution

3.1 Jointing

A. Joint size: 3/8 in.

3.2 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 ¾" in. for pointing.
E. Remove excess mortar from unit faces immediately after setting.
F. Tuck point unit joints to a slight concave profile.
G. Do not field apply water repellant until repair, cleaning, inspection and acceptance is completed.

End of Section 04 72 00

END OF DIVISION 04 – MASONRY

DIVISION 5 – Metals

Section 05 12 00 – Structural Steel

Part 1 – General

1.01 Section Includes

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

Section Includes:

1. Structural steel framing members
2. Baseplates, anchor bolts
3. Grouting under baseplates
4. Shop primer paint and surface preparation

1.02 Work Specified Elsewhere But Provided Under This Section

Section 04 05 00 – Masonry Mortar and Grout: Non-shrink grout

1.03 Products Furnished But Installed By Others

Section 03 30 00 – Concrete: Anchors for casting into concrete.

1.04 Related Sections

Section 05 22 00 – Steel Joists and Girders
Section 05 31 00 – Steel Deck
Section 05 50 00 – Metal Fabrications

1.05 Submittals

Shop drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, cambers, holes, and other pertinent data.
2. Provide templates for anchors and bolts for installation.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. 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.
5. Shop drawings shall be signed and sealed by a qualified professional engineer registered in the State of Wisconsin and responsible for their preparation.

Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shop primers

1.05 References

Codes and Standards: AISC "Code of Standard Practice for Steel Buildings and Bridges"; AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" including "Commentary"; AWS "Structural Welding Code - Steel"; Comply with applicable provisions except as otherwise indicated.

1.06 Quality Assurance

Installer Qualifications: Engage an experienced installer who has completed structural steel work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the work.

1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
    a. Category: Category I, conventional steel structures.
    b. Fabricator shall be registered with and approved by authorities having jurisdiction.

Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
3. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
4. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the 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 projects with structural steel framing that are similar to that indicated for this project in material, design, and extent

Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

Pre-installation Conference: Conduct conference at project site.

1.07 Delivery, Storage, and Handling

Deliver structural steel to project site in such quantities and at such times to ensure continuity of installation.

Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.08 Field Measurements
Verify that field measurements are as shown on shop drawings.

Part 2 - Products
2.01 Materials
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)

Rolled Wide Flange (w) shapes and channel © shapes: ASTM A572, Fy=50 KSI minimum.

Cold-Formed Steel Tubing: ASTM A 500, Grade B, Fy = 46 KSI

Steel Pipe: ASTM A 53, Type E or S, Grade B, Fy = 35 KSI.

Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490, unfinished bolts and nuts, ASTM A 307, Grade A.

Welding Electrodes: Comply with AWS requirements.

Galvanized Steel: Provide galvanized steel at exposed surfaces.

2.02 Primer
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.

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.

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
Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this section and in Shop Drawings.

1. Mark and match-mark materials for field assembly.
2. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
3. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
4. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

Plane thermally cut edges to be welded.

Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.04 Shop Connections

Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.

Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

2.05 Shop Priming

Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing.
5. Galvanized surfaces.

Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 2 "Hand Tool Cleaning."
2. SSPC-SP 3 "Power Tool Cleaning."
3. SSPC-SP 7 "Brush-Off Blast Cleaning."

Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC's "Painting System Guide No. 7.00" to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.06 Source Quality Control

General Building Contractor will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel work is being fabricated or produced so required inspection and testing can be accomplished.

Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

Additional testing, at contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165
2. 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.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

Part 3 - Execution

3.01 Erection

Comply with AISC Code and Specifications and maintain work in safe and stable condition during erection. Provide temporary bracing and shoring as required; remove when final connections placed.

Set base plates 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 per Section 04 06 50 at Erector's option.

Splice members only where shown on final shop drawings.

3.02 Field Connections

Install and tighten non-high-strength bolts, except where high-strength bolts are indicated.

Install and tighten high-strength bolts according to RCSC’s “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.”

Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

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

After installation, promptly clean, prepare, and prime paint or re-prime field connections, rust spots and abraded surfaces.

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.

Clean all surfaces of dirt, mud, oil, or grease that would impair bonding of fireproofing, concrete, or paint.

3.03 Field Quality Control

Contractor will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

1. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
2. Welded Connections: Field welds will be visually inspected according to AWS D1.1. Headed shear stud welds to be tested by the "hammer test method".
    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709, performed on root pass and on finished weld.
    c. Cracks or zones of incomplete fusion or penetration will not be accepted.
    d. Ultrasonic Inspection: ASTM E 164.
    e. Radiographic Inspection: ASTM E 94.

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

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

Section Includes:

1. Open web K Series steel joists.
2. Open web LH Series steel joists.
3. Bridging and bracing.
4. Joist accessories.
5. Joist Girders.

1.02 Related Sections

Section 05 12 00 – Structural Steel
Section 05 31 00 – Steel Roof Deck
Section 05 50 00 – Metal Fabrications

1.03 References

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

Shop Drawings: Submit complete plans, details and schedules for fabrication and erection, including layout, camber, special connections, jointing and accessories.

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

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.

Erector: Company specializing in performing the work of this section with a minimum 5 years' experience.

1.06 Delivery, Storage, and Handling

Deliver products to the site under the provisions of SJI requirements. Store and protect products from distortion or damage.

1.07 Field Measurements

Verify that field measurements are as shown on shop drawings.

Part 2 – Products

2.01 Materials

Steel: Comply with ASTM standards as referenced in the SJI "Specifications."

Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490, unfinished bolts and nuts, ASTM A 307, Grade A.

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.

Shop Paint: Rust inhibitive paint complying with SJI "Specifications".

2.02 Steel Joists

Manufacture steel joists according to SJI's "Specifications," with steel-angle top- and bottom-chord members, and as follows:

Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

Furnish special bearing seats and special extended ends.

Retain one or both subparagraphs below.

2.03 Joist Accessories

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.

Bridging: Schematically indicated. Detail and fabricate according to SJI “Specifications”.

Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.04 Finish

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

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.

Provide sufficient temporary bracing to maintain framing safe, plumb, and true alignment until completion of erection and installation of permanent bridging and bracing.

Coordinate placement of anchors on masonry construction for securing bearing plates and angles.

After joist alignment and installation of framing, field weld joist seat to bearing plates.

Position and field weld joist chord extensions and wall attachments.

Do not field cut or alter structural members without approval of joist fabricator.

After erection, prime welds, abrasions, and surfaces not shop primed.

Erection: 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.

3.02 Erection Tolerances

Maximum Variation From Plumb: ¼ inch

Maximum Offset From True Alignment: ½ inch

3.03 Field Quality Control

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

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

Section Includes:

1. Steel roof deck and accessories

1.02 Related Sections

Section 05 12 00 – Structural Steel
Section 05 22 00 – Steel Joists and Girders
Section 05 50 00 – Metal Fabrications

1.03 References

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

Shop Drawings: Include layout plans, deck type, deck gauge, anchorage details, and accessories.

1.05 Delivery, Storage, and Handling

Deliver to site, store and protect decking on dry wood sleepers.

1.06 Field Measurements

Verify that field measurements are as shown on shop drawings.

Part 2 - Products

2.01 Manufacturers:

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.
5. Approved equal

2.02 Materials

Steel Roof Deck: Comply with SDI requirements for type of sections, gauge, width and depth as shown on the structural drawings.

Sheet Steel for Painted Units: ASTM A 611, Grade C or D.

Sheet Steel for Galvanized Units: ASTM A 653, Grade A.

Power Actuated Fasteners: Provide fasteners as manufactured by Hilti model X-EDN19 or X-EDNK22 nails or approved equal.

Side Lap Fasteners: Provide screws as manufactured by Hilti No. 10 self tapping screws or approved equal.

2.03 Accessories

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.

Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the decking.

2.04 Fabrication

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.

Deck Units: Comply with SDI requirements for type of sections, of metal thickness, width, and depth indicated on drawings.

2.05 Shop Priming

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.

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

Verify that field conditions are acceptable and are ready to receive work.

Beginning of installation means installer accepts existing conditions.

3.02 Installation

Erect metal decking in accordance to SDI Design Manual for Composite Decks, Form Decks, and Roof Decks.

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.

Metal Roof Deck Fasteners: Furnish and install power actuated or pneumatically driven fasteners in accordance to deck manufacturers' instructions.

Side Lap Fasteners: Secure roof deck units at side laps with metal screws installed in accordance to manufacturer's instructions.

Accessories: Place accessory units in accordance to manufacturer's recommendations unless otherwise shown.

Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.

3.03 Touch-Up Painting

After installation, promptly clean all surfaces of dirt, mud, oil or grease that would impair bonding of touch-up coating.

Repair Painting: Wire brush and clean all rust spots and abraded areas of prime painted deck and apply repair paint.

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

Field Quality Control: All deck fasteners and side lap fasteners shall be inspected by a qualified testing agency prior to installation of insulation materials.

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

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

1.02 Summary

This section includes the following:

1. Loose bearing and leveling plates.
2. Loose steel lintels.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other sections.
6. Metal floor cover plates, open grip treads, and supports.
7. Steel pipe bollards with thermoplastic bollard sleeve covers.
8. Safety net trolley track assembly
9. Bent plate jamb protectors
10. Overhead door control station
11. Pit cover plate
12. Movable pit planks
13. Open grip treads

Related sections include the following:

1. Section 03 30 00 - Cast-in-place Concrete
2. Section 04 05 13 - Masonry Mortar and Grout.
3. Section 04 20 00 – Unit Masonry
4. Section 05 12 00 - Structural Steel
5. Section 05 52 13 - Pipe and Tube Railings for pipe and tube handrails, guardrails, and railings.
6. Section 06 40 00 – Interior Architectural Woodwork: Countertop support brackets.
7. Section 11 52 00 – Audio/Visual Equipment for ceiling mounted TV/monitor.

1.03 Submittals

Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint and powder coat products.

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.

Provide templates for anchors and bolts specified for installation under other sections.

Samples for Verification: For each type and finish of extruded nosing and tread.

1.04 Quality Assurance

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.

Welding: Qualify 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.

Comply with AISC Manual, current edition.

1. Code of Standard Practice for Steel Buildings and Bridges.
2. Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.

1.05 Project Conditions

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.

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

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

Deliver fabrications, materials including accessories, anchor bolts, setting and bearing plates to the site at such intervals to ensure uninterrupted progress of the work.

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 Metals - General

Metal Surfaces, General: For metal fabrications exposed to view in the completed work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.02 Ferrous Metals

Steel Plates, Shapes, and Bars: ASTM A 36.

Steel Tubing: Cold-formed steel tubing complying with ASTM A 500, Grade B.

Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153.

Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

Steel Plates to be Bent or Formed Cold: ASTM A 283.

Hot Rolled, Rail Carbon Steel Bars and Shapes: ASTM A 499.

Cold-Finished Steel Bars: ASTM A 108.

Steel Pipe: ASTM A 53, Grade B.

2.03 Stainless Steel Wire Rope and Fittings

Manufacturers

1. Cable Connection
2. Esmet, Inc.
3. Feeney Wire Rope and Rigging
4. Johnson C. Sherman, Co., Inc.
5. Loos & Co. Inc.; Cableware Division
6. Sava Industries, Inc.
7. Seco South, Inc.
8. Approved equal

Stainless Steel Rope Cable

1. 3/8-inch diameter wire rope made from wire complying with ASTM A 492, Type 316.

2. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to a minimum breaking strength of wire rope with which they are used.

2.04 Paint

Shop Primers: Provide primers that comply with Section 09 90 00 - Painting.

Shop Primer for Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Carboline 621; Carboline Company.
   b. Aquapon Zinc-Rich Primer 97-670; PPG Industries, Inc.
   c. Tneme-Zinc 90-97; Tnemec Company, Inc.
   d. Or approved equal.

Galvanizing Repair Paint: High-zinc-dust-content paint for repairing galvanizing at welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

2.05 Powder Coating

1. Dupont Alestra®
2. Cardinal
3. Sherwin Williams
4. ISF
5. Approved equal

2.06 Fasteners

General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

Anchor Bolts: ASTM F 1554, Grade 36.

Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

Wood Screws: Flat head, carbon steel, ASME B18.6.1.

Expansion Anchors:
Manufacturers:

1. Hilti® Inc
2. Red Head®
3. Unitx®
4. Approved equal

Applications:

1. steel expansion anchors for embedment in solid or precast concrete.
2. Sleeve anchors for anchoring into concrete masonry.

Lintel Bearing Plate Anchor Bolts: Unless shown otherwise, lintel bearing plates shall be fabricated with ½" dia. x 4" long headed studs.

Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.07 Grout
Refer to Section 04 05 13 - Masonry Mortar and Grout.

2.08 Concrete Fill
Concrete Materials and Properties: Comply with requirements in Division 3 section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.09 Fabrication, General
Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

Shear and punch metals cleanly and accurately. Remove burrs.

Ease exposed edges to a radius of approximately 1/16 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

Remove sharp or rough areas on exposed traffic surfaces.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.10 Loose Bearing and Leveling Plates

Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

Galvanize plates after fabrication.

2.11 Loose Steel Lintels

Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

Weld adjoining members together to form a single unit where indicated.

Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

Galvanize loose steel lintels located in exterior walls.

2.12 Pipe Bollards

Fabricate pipe bollards from hot-dipped galvanized Schedule 80 steel pipe.

PVC bollard sleeves: ¼" thick polyethylene thermoplastic sleeves with domed head profile. Color: Caution Yellow

2.13 Open Grip Treads

Basis-of-Design Product: The design is based on the product named. Subject to compliance with the requirements, provide either the named product or a comparable product by one of the other manufacturers specified (or approved equal):

1. Open Grip Treads: GRIP-STRUT, Manufactured by GS Metals Corp., Pinckneyville, IL.
    a. Plank Style: 5-Diamond, serrated grating, 11 ¾-inch width.
    b. Plank Material: 0.080-inch Aluminum alloy.
    c. Weight: 1.59 Pounds/foot.
    d. Channel Depth: 2-inches.
    e. End Panels (both sides): Manufacturer's standard tread strap; 0.080-inch aluminum. U-shaped strap with slot and hole configuration, spot fillet welded to strut.
    f. Accessories: 0.25 inch aluminum plates as indicated on the drawings.

2. McNichols Co.
3. REDD Team Mfg, Inc.
4. Or approved equal

2.14 Manifold Access Panels
Material: 3/8” thick galvanized diamond plate steel

Access panels shall be 20” wide x 30” long. Fabricate with countersunk fasteners at corners for easy removal.

Prime and paint light grey to match surrounding high traffic coating system.

2.15 Miscellaneous Framing and Supports
General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the work.

General: Provide steel framing and supports indicated and as necessary to complete the work.

Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

Galvanize miscellaneous framing and supports where indicated.

2.16 Safety Net Trolley Track Assembly
Where indicated on the drawings, provide steel tube track consisting of light-duty 1-5/8-inch O.D. steel enclosed track system 120 lb. load rated tube track manual trolley.

Manufacturer:

1. Martin Gregory Conveyor & Engineering Co.; Phone: (812) 923-9814.
2. Duratrack, Inc., Elk Grove Village, IL.
3. Unistrut Systems
4. Approved equal

2.17 Finishes, General
Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Finish metal fabrications after assembly.

2.18 Steel and Iron Finishes

Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

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 metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

Stripe paint corners, crevices, bolts, welds, and sharp edges.

Powder Coating: Shop apply polyester powder coating, minimum 4 mil film thickness.

Part 3 - Execution

3.01 Installation, General

Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 Setting Bearing and Leveling Plates

Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.03 Installing Miscellaneous Framing and Supports

General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

Anchor supports for operable partitions securely to and rigidly brace from building structure.

Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.

Do not grout baseplates of columns supporting steel girders until girders are installed and leveled.

Guardrail at stairs to scale tunnel

1. Verify that grouted CMU bearing surfaces are level and ready to receive guardrail posts.
2. Anchor guardrail posts with expansion anchors.

3.04 Adjusting and Cleaning

Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 section "Painting."

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

End of Section 05 50 00

Section 05 52 13 – Pipe and Tube Railings

Part 1 – General

1.01 Related Documents

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

1.02 Summary

This section includes the following:

1. Steel pipe and tube handrails, railings, and guardrails.

Related sections include the following:

1. Section 05 50 00 - Metal Fabrications
2. Section 32 31 19 - Decorative Metal Gates

1.03 Performance Requirements

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.

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

Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other work.

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 the following.

1. Handrails, guardrails, and railings.

1.05 Quality Assurance

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.

Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer.

1.06 Storage

Store handrails and railings in a dry, well-ventilated, weathertight place

1.07 Project Conditions

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.

1.08 Coordination

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.

1.09 Scheduling

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

General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

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: 0.145”
   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).

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

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.

Fasteners for Anchoring Handrails and Railings to Other Construction: 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 Paint

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.

2.04 Fabrication

General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less that that required to support structural loads.

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.

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.

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.

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.

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.

Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

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.

Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

Close exposed ends of handrail and railing members with prefabricated end fittings.

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 ¼ inch (6 mm) or less.

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.

Cut, reinforce, drill, and top components as required to receive stainless steel cable system.

2.05 Finishes, General

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.

2.06 Steel Finishes

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.

For non-galvanized steel handrails and railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

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."

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.

Stripe paint edges, corners, crevices, bolts, and welds.

Part 3 – Execution

3.01 Examination

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

Fit exposed connections together to form tight, hairline joints.

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 ¼ inch in 12 feet (5 mm in 3 m).

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.

Fastening to In-Place Construction: Use anchorage devices and fasteners here necessary for securing handrails and railings and for properly transferring loads to inplace construction.

3.03 Railing Connections

Welded Connections: use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections tin "Fabrication" Article whether welding is performed in the shop or in the field.

3.04 Anchoring Posts

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:

For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.05 Anchoring Railing Ends

Anchor posts to metal surfaces with oval flanges bolted to metal surfaces.

1. Weld flanges to railing ends.

3.06 Attaching Handrails To Walls

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.

Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.07 Cleaning

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

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.

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

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

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.

Work includes:

1. Treated wood blocking at roof edge
2. Treated wood blocking at translucent panel sill.
3. Wood blocking, furring
4. Fasteners, anchors

1.02 Related Sections

Section 06 20 00 – Finish Carpentry
Section 06 40 00 – Interior Architectural Woodwork

1.03 Submittals

Product data for engineered wood products, sheathing, framing connectors, and construction adhesives.

Part 2 - Products

2.01 Framing Materials

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.

Provide seasoned lumber with 19 percent moisture content at time of dressing and shipment, for sizes 2 inches or less in thickness.

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.

Provide all miscellaneous wood blocking not indicated as provided by other trades/sections.

Preservative pressure treat lumber and plywood with water-borne preservatives to comply with AWPA 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.
2. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.05 Fasteners:

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

Install rough carpentry work to comply with N.F.P.A. "Manual of House Framing, Form E30," "APA Design/Construction Guide - Residential and 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.

Set rough carpentry to required levels and lines, with members plumb and true and cut to fit.

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.

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 16 43 – Exterior Gypsum Wall Sheathing

Part 1 – General

1.01 Summary of Work:
Applicable provisions of Division 1 shall govern the work under this section.

Work includes:

Furnish and install glass mat gypsum sheathing board wall sheathing.

1.02 Related Work Specified Elsewhere:

Section 07 27 26 – Fluid Applied Membrane Air Barrier Membrane
Section 09 22 16 – Non-load Bearing Metal Wall Framing

1.03 Submittals
Product Data: Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance.

Certificates: Submit manufacturer's written certification that product meets specified requirements.

1.04 Quality Assurance
Fire-resistance ratings: Where applicable, provide materials and construction that are identical to those of assemblies whose fire-resistance ratings are indicated.

1.05 Delivery, Storage and Handling
Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible.

Storage and handling: Store level and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

1.06 Limitations
Do not use sheathing as a base for nailing or mechanical fastening. Fasteners should be flush to the face of the board, not countersunk.

The use of forced air heaters creates volumes of water vapor which, when not properly vented, can condense on building materials. The use of these type heaters and any resulting damage is not the responsibility of the sheathing manufacturer. Consult heater manufacturer for proper use and ventilation. Avoid any condition that will create moisture in the air and condensation on the exterior walls during periods when the exterior temperature is lower than the interior.

Do not laminate sheathing to masonry surfaces; use furring strips or framing spaced at manufacturer's specifications.

Do not apply sheathing below grade.

For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed per system specifications. Openings and penetrations must be properly flashed and sealed. Failure to do so will void the warranty.

1.07 Warranty

Materials Warranty: Provide sheathing manufacturer's standard warranty covering sheathing materials for five years commencing on date of purchase.

Weathering Warranty: Provide sheathing manufacturer's standard warranty covering in-place exposure damage to sheathing for six months commencing on date of purchase by contractor.

Part 2 - Products

2.01 Manufacturers

1. Georgia-Pacific Co. "Dens-Glass Gold"
2. US Gypsum "Aqua-Tough"
3. CertainTeed "GlasRoc"
4. Approved equal

2.02 Materials

Size: 4' x 8', 9' or 10' (contractor's option).

Thickness: 5/8 inch

Composition: Gypsum sheathing manufactured in accordance to ASTM C 1177 with glass mats both sides and long edges, water-resistant treated core.

Fire resistance:

1. Noncombustible when tested in accordance to ASTM E 136.
2. Flame spread 0, smoke developed 0, when tested in accordance to ASTM E 84.

2.03 Accessories

Screws, metal framing:

1. Type S-12, bugle head, self-tapping, rust-resistant, fine thread for heavy-steel gauge (12 to 22).
2. Type S, bugle head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

Sealants, Caulk and Tape:

1. Dow Corning 795 or equivalent; Pecora 895 or equivalent.
2. Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent; Pecora AC-20 acrylic latex sealant; GE Silicone Silpruf Sealant; Tremco Dymonic
3. 2" wide 10 x 10 glass mesh Quick Tape or equivalent

Part 3 - Execution

3.01 Preparation

Examine subframing; verify that surface of framing and furring members are ready to receive sheathing.

3.02 Sheathing

Install sheathing where indicated on drawings in accordance to manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280.

Use maximum lengths possible to minimize number of joints.

Metal Framing: Attach sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.

Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.

Locate fasteners minimum 3/8" from edges and ends of sheathing panels.

Finishing:

1. Seal fasteners using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent.
2. Finish joints using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent. Reinforce with 2" wide 10 x 10 glass mesh Quick Tape or equivalent.

End of Section 06 16 43

Section 06 20 00 – Finish Carpentry

Part 1 - General

1.01 Work Included
Applicable provisions of Division 1 shall govern the work under this section.

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
Section 06 10 00 – Rough Carpentry
Section 06 40 00 – Interior Architectural Woodwork
Section 08 11 13 – Steel Doors and Frames
Section 08 71 00 – Finish Hardware
Section 10 28 00 – Toilet and Bath Accessories

Part 2 - Products

2.01 Materials
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.

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
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

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

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

Section 06 10 00 – Rough Carpentry
Section 06 20 00 – Finished Carpentry

1.03 References

ANSI / BHMA A156.9 – Cabinet Hardware
AWI – Quality Standards

1.04 Submittals

Shop Drawings: Submit shop drawings for each item of architectural woodwork.

Hardwood Wainscoting: Submit complete shop drawings including elevations of all walls scheduled to receive wood wainscoting. Elevations shall indicate panel widths and layout spacings using the multiple panel widths available from the manufacturer and specified herein.

Samples: Submit finished samples of each wood species and cut indicated for transparent finish; of each material indicated for opaque finish; of each color, pattern, and finish of plastic laminate; and of each type of cabinet hardware.

Hardwood Wainscoting: Submit component samples for on-site mock-up section by contractor. Samples shall be of wood species and veneer specified under this specification section.

1.05 Qualifications

Manufacturer: Company specializing in the manufacturing the products specified in this section with a minimum of five years of experience.

1.06 Field Measurements

The cabinet manufacturer shall be responsible for confirming all field measurements prior to fabrication.

Part 2 - Products

2.01 Plastic Laminate Materials

Manufacturers

1. The color selections listed in the Color Schedule is based on plasticlaminates manufactured by Formica. The following manufacturer's will be accepted subject to approval by the architect.
    a. Wilsonart
    b. Nevamar
    c. Pionite
    d. Approved equal

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.

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 <u>not</u> 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 in accordance to Paragraph 2.01.C, 6., "Edging Locations":
   a. PVC, .020". Solid, high impact, purified, color-through, acid resistant PVC edging.
   b. 3mm thick PVC. Solid, high impact, purified, color-through, 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 and 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

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.

Pulls:

1. 4” Wire design: Stanley #4484.
2. Provide two at drawers over 29".
3. Finish to be available in chrome powder finish, black, beige, dove gray, or white epoxy coated.

Drawer Slides:

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.

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.

Adjustable Shelf Supports: To be twin pin design with anti tip-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.

Locks: Hinged doors and drawers to be provided with disc tumbler lock keyed alike and master keyed. Dull chrome finish.

Manufacturers
1. National Cabinet Lock, Atlanta, GA, #M4-7054
2. Timberline
3. Best
4. Approved equal

2.03 Countertop Support Brackets
Countertop support brackets shall be shop fabricated from ¼" 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.

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
Manufacturers:
1. Meganite™ Acrylic Solid Surface
2. Avonite
3. Corian
4. Approved equal

Colors: Refer to Color Schedule.

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 manufacturers standard oval shaped integral bowl.
    a. Color: Selected from manufacturer's standard range of colors.
    b. Inside Dimensions: 18-1/2" x 12-1/2" x 5-1/8" deep

Window Stools: Fabricate from ½-inch thick solid surface to stool depth indicated on the plan with a 1-1/4-inch dropped edge and 1 inch "ear" extensions at window jamb openings.

2.05 Fabrication
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 1¼" 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 3¾" 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 ¼" 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 ½" 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 ¼" thick, smooth both faces. Secured in cabinet with molded plastic clips.
   i. Pressure Fused laminate ¾" thickness. Secured in cabinet with molded plastic clips or dowels.

j. Door/Drawer Front Rail: Provide minimum ¾" x 6" x full width cabinet body rails immediately behind all door/drawer and multiple drawer horizontal joints.

Plastic Laminate Countertops
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. Provide field glued splines at joints. No joints closer than 24" either side of sink cutout.

2.06 Field Finishes for Architectural Woodwork:
Finishing by Section 09 90 00.

Part 3 - Execution
3.01 Examination
Verify adequacy of backing and support framing.

3.02 Installation
Set and secure casework in place; rigid, plumb, and level.

Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

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

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.

2. Surface preparation.
3. Application of rolled, self-adhering waterproofing membrane system.
4. Rigid insulation protection board.

1.02 Related Sections

Section 03 30 00 - Cast-in-Place Concrete.
Section 07 21 13 – Board Insulation: Protection board

1.03 References

ASTM D 146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

ASTM D 412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

ASTM D 570-98 - Standard Test Method for Water Absorption of Plastics.

ASTM E 96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

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

Submit manufacturer's product data and application instructions.

1.05 Delivery, Storage, and Handling

Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

Store materials in a clean dry area in accordance to manufacturer's instructions.

Store adhesives and primers at temperatures of 40oF (5oC) and above to facilitate handling.

Store membrane cartons on pallets.

Do not store at temperatures above 90^{o}F (32^{o}C) for extended periods.

Keep away from sparks and flames.

Completely cover when stored outside. Protect from rain.

Protect materials during handling and application to prevent damage or contamination.

1.06 Environmental Requirements

Product not intended for uses subject to abuse or permanent exposure to the elements.

Protect rolls from direct sunlight until ready for use.

Do not apply membrane when air or surface temperatures are below 40^{o}F (4^{o}C).

Do not apply to frozen concrete.

Part 2 - Products

2.01 Manufacturers

Foundation Wall Membrane

Carlisle Coatings and Waterproofing; MiraDRI 860/861
Grace Construction Products; Bituthene 3000
W. R. Meadows, Inc., Hampshire, IL: Mel-Rol
Approved equal

Underslab Membrane

Grace 300 Preprufe
CETCO® 'Coreflex 30'
Approved equal

2.02 Materials – Foundation Wall Waterproofing Membrane

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 -25oF (-32oC): Unaffected.
   f. Water Vapor Permeance, ASTM E 96, Method B: 5.72 x 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 (73.1m) 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

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 231 feet 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 B.

2.04 Accessories

Primer:

1. Temperatures Above 40^{o}F (4^{o}C): Manufacturer's recommended water base primer
2. Temperatures Above 20^{o}F (-7^{o}C): Manufacturer's recommended VOC Compliant Solvent Base Primer or Standard Solvent Base Primer.

Flashing and Fillets: Manufacturer's standard liquid membrane.

Pointing Mastic

Corner Tape: Detail Strip.

Waterproofing Protection Course: Refer to Section 07 21 13–Board Insulation

Part 3 - Execution

3.01 Examination

Examine surfaces to receive membrane. Notify the architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 Surface Preparation

Protect adjacent surfaces not designated to receive waterproofing.

Clean and prepare surfaces to receive waterproofing in accordance to manufacturer's instructions.

Do not apply waterproofing to surfaces unacceptable to manufacturer.

Concrete surfaces must be clean, smooth and free of standing water.

Patch all holes and voids and smooth out any surface misalignments.

3.03 Application - Vertical Surfaces

Apply waterproofing membrane system in accordance to manufacturer's instructions.

Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.

Prime surfaces to be covered in one working day with applicable primer. Re-prime uncovered surfaces next day.

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.

Perform flood testing of horizontal applications, as required. Mark leaks and repair when membrane dries.

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

Strictly comply with installation instructions in manufacturer's published literature, including but not limited to, the following:

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.

1. Leave the plastic release liner in position until overlap procedure is completed.
2. 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.
3. 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.
4. Completely remove the plastic liner to expose the protective coating. Any initial tack will quickly disappear.

3.05 Protection Board Installation
Prepare and clean waterproof membrane surface.

Apply rigid insulation boards with long edge horizontally.

Secure boards to foundation wall with adhesive prior to backfilling operations. Butt all edges tightly.

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

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
Section 03 30 00 – Cast-In-Place Concrete
Section 04 20 00 – Unit Masonry : Cavity wall insulation
Section 07 13 53 – Elastomeric Sheet Waterproofing: Protection board

1.03 References
ASTM C578-92, standard specification for rigid, cellular polystyrene thermal insulation.

Part 2 - Materials

2.01 Manufacturers

5. Dow ‘Styrofoam’
6. Owens Corning ‘Foamular®
7. Diversifoam Products ‘Certifoam’
8. Approved equal

2.02 Materials
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
    c. Horizontal Surface Protection Board: 25
    d. Underslab Insulation @ Operations Building: 40 psi
    e. Underslab Insulation @ Inspection Building: 60 psi
    f. Roof Overhang Soffit: 25 psi

Adhesive:
Adhere insulation to concrete foundation walls adhesive as recommended by board manufacturer.

Part 3 - Execution

3.01 Preparation

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.

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.

If not indicated, extend insulation a minimum of 48 inches below exterior grade line.

3.02 Installation

Underslab Insulation

Butt end joints and edges tight to adjacent board.

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

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

Work includes:

1. Fiberglass batt wall insulation.
2. Vapor retarder membrane barrier

1.02 Related Sections

Section 09 22 16 – Metal Studs

1.03 References

ASTM C665 – Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

FS HH-I-521 – Insulation Blankets, Thermal

1.04 Performance

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.

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

Product Information: Submit product data for each form and type of insulation indicated.

Part 2 – Products

2.01 Manufacturers

Fiberglass Batt Insulation

1. Johns Manville
2. Knauf
3. Owens Corning
4. CertainTeed
5. Approved equal

Reinforced-Polyethylene Vapor Retarders

1. Ravin Industries, Inc., Sioux Falls, SD; DURA-SKRIM 6WW
2. Reef Industries, Inc., Houston, TX: Griffolyn® Type-65
3. Approved equal

2.02 Materials

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.

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

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 contractor prior to proceeding with installation of batt insulation.

3.02 Installation

Insulation

1. Install insulation in accordance 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.

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 (Core Fill)

Part 1 – General

1.01 Scope of Work
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

Work includes;
Foamed-in-place masonry insulation

1.02 Related Sections

1.03 Submittals
Products and technical presentation as provided by the manufacturer.

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.

Material Safety Data Sheet; Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.04 Quality Assurance
Manufacturing Standards: Provide Insulation produced by a single and approved manufacturer.

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.

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 Manufacturer

1. Tailored Chemical Products, Hickory, N.C.: "Core-Fill 500"
2. Thermco™, Thermal Cororation of America, Mt. Pleasant, IA
3. Core-Foam, Inc., Knoxville, TN
4. Approved equal

2.02 Insulating Materials

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 hour fire resistance wall rating (ASTM E-119) for 8-inch and 12-inch 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-inch wall assembly (ASTM E 90-90).

Part 3 – Execution

3.01 Preparation

Verify that work by other trades to be embedded in CMU walls has been completed and ready to be encapsulated with foam.

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

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.

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

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

Work includes:

The work shall consist of covering all areas shown on the drawings with nailbase roof insulation.

1.02 Related Work

Section 05 31 00 – Steel Decking
Section 07 41 00 - Standing Seam Metal Roof System

1.03 Performance Requirements

Performance requirements:

1. The wood spacer blocks within the ventilation space shall not exceed 5% of the panel area and will allow air flow both up the slope and horizontally. The air space shall provide a minimum of 9 Sq. In. of Net Free Area per linear foot of insulation.
2. The spacer blocks within the ventilated area and the sheathing panels below the ventilated area, shall be sufficient to avoid compression of the isocyanurate insulation under a compressive load of 200 p.s.f.
3. The isocyanurate foam insulation shall have a density averaging at least 2 p.c.f. and a compression resistance of 20 p.s.i.
4. The isocyanurate foam shall have a Flame Spread Rating of 25 or less.

1.04 Quality Assurance

Each bundle of ventilated 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.

The ventilated 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.

1.05 References

Foam insulation shall comply with FMRC Std. 4450/4470.

1.06 Submittals

Copies of the manufacturer’s ventilated insulation catalog and installation instructions shall be submitted along with a sample of the product.

1.07 Delivery Storage and Handling

The ventilated insulation shall be protected in transit by stretch wrapping and by truck tarps.

Material stored at the jobsite shall be covered with tarps.

1.08 Project/Site Conditions

If material is stored at the jobsite, a reasonable level, drained storage area shall be provided.

1.09 Sequencing/Scheduling

Erection of the ventilated insulation shall be coordinated with the roofing subcontractor so that the roofing is applied as soon as possible after insulation is in place.

Part 2 – Products

2.01 Acceptable Manufacturers

1. Atlas Roofing Corp., Atlanta, GA
2. Cornell Corporation, Cornell, WI ; ThermaCal 1 non-vented
3. Johns Manville, Denver, CO
4. Approved equal

2.02 Materials

Description of System :

1. The roof insulation shall be a factory assembled panel consisting of a 5/8" oriented strand board top surface, and a layer of felt on the bottom. (Note: Spacer blocks cut from foam insulation will not be acceptable.)
2. The overall thickness of the ventilated roof insulation shall be 4-5/8" with a 'Long Term Thermal Resistance' (LTTR) R value = 24.2.
3. Foam insulation edges shall be tongue and groove.
3. Panels shall be a nominal 48" x 96" and shall be accurately trimmed to length and width after assembly. Edges shall be rabbetted to allow clearance between the wood on adjoining panels.

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

The structural roof deck shall be smooth and level and free of water or debris before the ventilated insulation is installed.

3.02 Installation

Installation shall follow the manufacturer's written installation instructions shipped with the material. Protect ventilated insulation 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
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

This section specifies the following:
Water-resistant fluid-applied air and vapor barrier in exterior masonry wall assemblies.

Spray-applied polyurethane foam.

1.02 Related Work By Others
Section 04 20 00 – Unit Masonry
Section 06 16 43 – Gypsum Sheathing

1.03 Performance Requirements
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) (0.02 L/m^2 @ 75 Pa.) when tested according to ASTM E 2178.

1.04 Submittals
Submittals: Submit in accordance to Division 1 – General Requirements.

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.

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.

Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.

1.05 Quality Assurance
Air Barrier Installer Qualifications: Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified in accordance to the ABAA Quality Assurance Program.

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.

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).

VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.

1.06 Delivery, Storage and Handling

Deliver materials to project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

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.

Handle materials in accordance to manufacturer's recommendations.

1.07 Project Conditions

Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer.

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 in accordance to manufacturer's recommendations.

1.08 Warranty

Material Warranty: Provide manufacturer's standard product warranty, for a minimum 3 years from date of Substantial Completion.

Part 2 – Products

2.01 Materials – General

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.

2.02 Manufacturers – 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 Through-Wall Flashing.
    f. Mastics, Adhesives and Tapes: Pointing Mastic.
    g. Website: www.wrmeadows.com.

2.03 Manufacturers - Spray Polyurethane Foam Insulation

1. Commercial Thermal Solutions
2. BASF
3. CertainTeed Saint-Gobain ‘CertaSpray®Closed Cell Foam
4. Approved equal

2.04 Auxiliary Materials

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

Examine substrates, areas, and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.

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.

Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.

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

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.

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.

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

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 in accordance 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:

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.

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.

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.

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.

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.

Overlap horizontally adjacent pieces of transition strips a minimum of 2 inch(5mm), unless greater overlap is recommended by manufacturer. Roll seams with roller.

Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance to manufacturer's recommendations.

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 in accordance to the manufacturer's recommendations.

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.

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.

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

Apply spray polyurethane where indicated on the drawings as a component of the building air barrier system.

3.05 Field Quality Control

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

Protect air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.

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

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

Work Includes:

1. Standing seam metal roof panels.
2. Fasteners, clips, furring channels, flashings, and miscellaneous accessories.
3. Gutters and 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

1.02 Related Work

Section 07 22 00 – Nail Base Roof Insulation
Section 07 60 00 – Flashing and Sheet Metal
Section 07 71 23 – Manufactured Gutters and Downspouts
Division 22 – Plumbing: Roof vent penetrations
Division 23 – HVAC: Roof top mounted equipment and duct penetrations.

1.03 Submittals

Product Data: Submit manufacturer's specifications and installation instructions.

Shop Drawings: Submit shop drawings consisting of catalog outs, design and erection drawings, finish specification, and other data necessary to clearly describe design materials, sizes, layouts, construction details, fasteners, and erection.

Samples

Roof Panel: Full panel width, 12 inches long including mechanically seamed standing seam.

Test Reports: Submit test reports prepared by (UL) Underwriters Laboratories, Inc. indicating wind uplift rating of proposed roof system.

1.04 Quality Assurance

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.

Applicator Qualifications: Five years minimum experience in application of standing seam roofs.

1.05 Performance Requirements

No water penetration of the panel assembly shall be permitted when tested at 20 psf pressure for 15 minutes in accordance to ASTM Test Procedure E331.

Deflection shall be limited to L/240 for positive loading.

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

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

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 in accordance to standard procedures specified in ASTM D 659-74.
3. Will not peel, crack, chip or delaminate.

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

Metal Roof Panels

1. Peterson Aluminum (PAC-CLAD): Tite-Loc
2. Firestone Una-Clad 'UC-3'
3. Berridge Manufacturing Co.; Houston, TX
4. AEP Span, Dallas, TX
5. Approved equal

2.02 Materials

Roof Panels:

1. General: Metal roof panel system shall consist of a mechanically field-seamed to a 90 degree lock-formed with 2" high field seamed standing seams.
2. Steel: AISI G90 hot dipped galvanized, extra-smooth primed and finished on one side.
3. 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.
4. Center to center panel width: 18 inches
5. Individual panels shall be removable for replacement of damaged material without disturbing adjacent panels.
6. Fabricate panels in full length with no end laps.
7. Provide factory eave notching where conditions require fascia returns.
8. Flashing and trim shall be of the same material, gauge, finish, and color as the panels.
9. Color: Match Peterson Aluminum 'Colonial Red'

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.

Self-Adhering Sheet Membrane Roofing Underlayment:

1. Manufacturers
   a. Carlisle Coatings and Waterproofing: CCW WIP 403HR
   b. Grace Co. Ice and 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 silconized release sheet. Roofing underlayment shall meet or exceed UL-790 Tests for Fire Resistance of Roof Coating Materials Class A and C.

Gutters: Refer to Section 07 71 12 – Manufactured Gutters and Downspouts

Metal Flashing Accessories: Refer to Section 07 60 00 – Flashing and Sheet Metal.

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.

Part 3 - Execution

3.01 Inspection

The installer shall examine the building to verify that the structure is ready for roofing installation.

All structural supports shall be in place and all sag rods, diagonal bracing and connections shall be tightened before work can proceed.

Field check dimensions and check support alignment with a taut string or wire; support misalignment will cause panel “oil-canning”.

Do not proceed until unsatisfactory conditions are corrected.

3.02 Installation

Self-Adhering Ice and 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.

Standing Seam Metal Roofing:

1. Install metal panel system in accordance to approved erection drawings and instructions.
2. All attachments shall allow for thermal expansion and contraction of the roofing panels.
3. 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.

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.

End of Section 07 41 00

Section 07 42 13 – Metal Wall Panels

Part 1 – General

1.01 Section Includes

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

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

B. Includes:

1. Foamed insulation core horizontal metal wall panel assembly with integral reveals.
2. Related metal trim and accessories.

1.2 Related Work

Section 07 60 00 – Flashing and Sheet Metal
Section 07 92 00 – Joint Sealants

1.3 References

American Architectural Manufacturer's Association (AAMA):

1. AAMA 605.2 – Voluntary Specification for High Performance Organic Coatings for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
2. AAMA 508-05 – Test method for Pressure Equalized Rain Screen Wall Systems.

American Society of Civil Engineers (ASCE):

1. ASCE- 7 Minimum Design Loads for Buildings and Other Structures

ASTM International (ASTM):

1. ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc iron Alloy-Coated (Galvannealed) by the Hot-dip Process.
2. ASTM C 920 – Specification for Elastometric Joint Sealants.
3. ASTM E 84 – Test Methods for Surface Burning Characteristics of Building Materials.
4. ASTM E 96 – Test Methods for Water Vapor Transmission of Materials.
5. ASTM # 119 – Test Methods for Fire Tests of Building Construction and Materials.

Underwriters Laboratories, Inc. (UL):

1. UL263 – Fire Resistance Tests of Building Construction and Materials.
2. UL 723 – Test for Surface burning Characteristics of building materials
3. Fire Resistance Directory
4. UL 1715 Room Corner Test

1.4 Performance Requirements

A. Air Infiltration: Maximum 0.06 cfm/sf (0.3 L/s per sq.m) per ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sf (300 Pa) using minimum 10 feet by 10 feet (3050mm by 3050) test panel that includes horizontal and vertical joints.

B. Water Penetration – Dynamic Testing: No uncontrolled water penetration per AAMA 501.1 at a minimum pressure differential of 15 lb/sf (.72 kPa) using a minimum 10 feet by 10 feet (3050mm by 3050mm) test panel.

C. Horizontal Panel Joint Performance – Static test per ASTM E331 with horizontal seals removed – I inch (25 mm) in 10 feet (3050 mm) lengths to simulate seal defects. No uncontrolled water penetration permitted at a pressure of 15 lb/sf (.90 kPa).

D. Pressure Equalization of Horizontal Joinery – Passes the Criteria for a Pressure Equalized Horizontal Joint in accordance to AAMA 508-05 a test method for Pressure Equalized Rain Screen Wall Systems.

E. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated per ASTM E-72.

1. Wind Loads: Determine loads based on uniform pressure indicated on Drawings or calculated per IBC 2003 whichever is more stringent.
2. Deflection Limits: Withstand test pressures of inward and outward wind-load design pressures with maximum deflection of L/180 of the span with no failure.
3. Secondary Framing: Design secondary framing system according to AISI 'Standard for Cold-Formed Steel Framing – General Provisions.' Provide bearing surface for metal wall panels at the following locations:
    a. Horizontal Panel System: At vertical joints 4 inches minimum (102 mm).
    b. Vertical Panel System: At horizontal stack joints 4 inches minimum (102mm).

1.5 Submittals

A. Product Data: Manufacturer's data sheets for metal wall panels and accessories.

B. Product Test Reports: indicating compliance of products with requirements, from a qualified independent testing agency.

1.6 WARRANTY

A. Standard Warranty – The manufacturer shall warrant for a period of two years that the wall system materials will be free from defects. The wall systems contractor shall warrant for a period of two years that the installation workmanship will be free from defects.

B. Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panels that evidence deterioration of fluropolymer finish within 20 years from date of Substantial Completion.

Part 2 - Products

2.1 Manufacturers

A. Centria Architectural Systems
B. Metl-Span
C. Kingspan Benchmark
D. Approved equal

2.2 Foamed Insulation Core Metal Wall Panels

A. Panel System Product

1. CENTRIA, Forma Wall Graphix Series 2 (2 inches (51mm) thick panel).
2. Factory-foamed horizontal and vertical wall panel system consisting of an exterior metal sheet with interior metal liner panel, bonded to factory foamed-in-place core in thermally-separated profile, with factory sealed tongue-and-groove and rainscreen-design pressure –equalized-chamber horizontal joint, and attached to supports using concealed fasteners.
3. Foamed Insulation Core: urethane or isocyanurate, density 2.7 lb/cu. Ft. min (43.4 kg/cu.m), min compressive strength 20 lb/sq.in. (137.9 kPa), and containing no CFC or HCFC compounds.
4. Thermal performance of the wall panels shall be based on tests in accordance to ASTM C236 corrected to 15 mph outside and still air inside. Tests shall include side-joint, standard fastening and integral reveals or profiling. Values are based upon a full panel thickness. Where reveals exceed the standard or multiple segmented joints are required, the manufacturer shall provide similar testing to document any adjustments required to the standard conditions.
   a. R value for 2” flat panel shall be 14.
5. Panel Sealant/Vapor Seal: Factory-applied non-curing butyl.

B. Steel Sheet Exterior and Interior Facing: Contractor engineered panel meeting requirements indicated in Performance Requirements Article.

C. Face sheet shall be 22 gage (0.70 mm) or 20 gage (0.91 mm):

1. Surface: Embossed.

D. Liner Sheet: 26 gage, 0.0179 inch (0.45 mm) (G-90 coating, embossed, planked with .2 mil primer and 0.6 mil acrylic finish.

E. Liner Sheet: 22 gage, 0.0299 inch (0.75 mm) G-90 coating, embossed, planked with .2 mil primer and 0.6 mil acrylic finish.

F. Panel System Design:

1. Panel Joinery:
   a. Horizontal Panels: Rain Screen design with equalized pressure chamber.
2. Panel Width and Length: Refer to Contract drawings.
3. Horizontal panel reveal depth to be a minimum of 1-3/16 inches (30 mm) for 2” panel.
4. Exterior face to have intermediate segmented joints that are 5/8” wide and ¾” deep.

5. The inside of the segmented joint to be one of the following:
   a. Black, fire-retardant neoprene gasket-factory applied.
   b. Painted aluminum strip, color that contrasts from the panel TBD-factory applied and meets C2C certification.
   c. Metal in the same color as the face panel and meets C2C certification.
6. Segmented joints are located as shown on the drawings.
7. Option to the segmented joint faced panel is to produce individual panels that create the same appearance in width and length as shown on the drawings.

2.3 Materials

A. Metallic-Coated Steel Face Sheet, Coil Coated, per ASTM A 755/A 755M:

1. Zinc-coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90, structural quality. NOTE-Galvalume is not an acceptable substrate for architectural metal wall panels.

2.4 Finish

A. Standard Fluoropolymer Two-Coat system consists of 0.2 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat.

B. Color: Custom color to match standing seam metal roofing.

2.5 Accessories

A. Metal Wall Panel Accessories
   1. Provide complete metal wall panel assembly incorporating trim, copings, fascia, parapet caps, soffits, sills, inside and outside corners, jambs and miscellaneous flashings. Include required fasteners, gaskets, closure strips and sealants.
   2. All exposed trim and extrusions shall be finished to match panel.

2.6 Miscellaneous Materials

A. Sealant: Synthetic non-skinning butyl rubber sealant, as recommended by panel manufacturer, for metal wall panel assemblies to remain watertight.

B. Fasteners: Self-tapping screws, bolts, nuts and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal wall panels by means factory-applied coating.

Part 3 - Execution

3.1 Installation

A. Install miscellaneous framing and anchorage according to ASTM C754, metal wall panel manufacturer's written recommendations, and approved shop drawings.

B. General: Install metal wall panels in orientation, sizes and locations indicated. Anchor metal wall panels and other components securely in place. Provide for thermal and structural movement.
   1. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as approved by manufacturer.
   2. Field cutting of metal wall panels is not permitted.
   3. Fasten metal wall panels to supports with concealed clips at each joint or locations as shown on the shop drawings, with self tapping fasteners as recommended by the manufacturer.
   4. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

C. Fasteners for Steel Wall Panels
   1. Exterior: Stainless-steel
   2. Interior: Carbon steel

D. Metal Protection: Provide metal wall panel manufacturer's recommended permanent separation material where dissimilar metals will contact each other or corrosive substrates.

E. Joint Sealers: Install gaskets, joint fillers and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies.
   1. Seal metal wall panel accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   2. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.2 Accessory Installation

A. General: Install metal wall panel accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install related flashings and sheet metal trim per requirements of Division 07 Section 'Sheet Metal Flashing and Trim'.
   2. Install components required for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips and similar items.
   3. Comply with performance requirements and manufacturer's written installation instructions.
   4. Provide concealed fasteners except where noted on approved shop drawings.
   5. Set units true to line and level as indicated. Install work with laps, joints and seams that will be permanently watertight and weather resistant.

3.3 Cleaning and Protection

A. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.

B. Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair.

End of Section 07 42 13

Section 07 46 00 – Prefinished Metal Soffit Panels

Part 1 - General

1.1 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

1.2 Related Sections

A. Section 07 60 00 – Flashing and Sheet Metal

B. Section 09 22 16 – Non-load Bearing Metal Wall Framing

1.3 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.

1.4 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

2.1 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’.

3. McElroy Metal Inc.; Bossier City, LA: Marquee Series
4. Approved equal

2.2 Materials

A. Soffit Panels
1. Panel Profile: Non-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. 'Z'-Furring: Galvanized 25 gauge x custom depth "Z" profile with 1-1/4"wide flange for placement against the substrate.

2.3 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

3.1 Installation

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 in accordance 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.

3.2 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

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

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. Miscellaneous sheet metal accessories.

1.02 Related Sections

Section 04 20 00 – Unit Masonry: Metal drip edge at through-wall flashing
Section 07 41 00 – Standing Seam Metal Roofing
Section 07 63 00 – Vented Roof Edge Fascia
Section 07 71 12 – Gutters and Downspouts
Section 08 84 00 – Insulated Translucent Panels: Sill Flashing

1.03 Submittals

Shop drawings showing layout, profiles, method of joining, anchorage details, etc.

Samples for Verification: For each type of exposed flashing required indicated below:

1. Stainless steel drip edge for embedment if masonry walls.
2. Stainless steel receiver and counterflashing at embedded metal roof flashing.
3. Prefinished galvanized steel sill flashing at windows and translucent panels.
4. Prefinished galvanized steel column enclosure cladding.
5. Roof penetration flashings

1.04 Performance

Performance: Watertight and weatherproof performance of flashing and sheet metal work is required.

1.05 Warranty

Provide manufacturers 20 year written guarantee covering film integrity, fading, chalking.

Part 2 – Products

2.01 Materials

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. Vincent Metals "Colorklad".
   d. AEP Span
   e. MetalEra, Inc.

Aluminum Sheet: ASTM B 209, alloy 3003-H14, 0.032 inch (20 ga.).

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.

Stainless Steel: ASTM A 240/A 240M, Type 304

2.02 Fabrication

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.

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.

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.

Provide joint covers at 10-foot intervals with no exposed fasteners on face.

Part 3 – Execution

3.01 Installation

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.

Seal moving joints in metal work with elastomeric joint sealants, complying with requirements specified in Division 7 Section "Joint Sealants."

Clean metal surfaces of soldering flux and other substances which could cause corrosion.

Nail flanges of expansion joint units to substrates at spacing of 6 inches o.c.

Composition Stripping: Cover flanges (edges) of work set on bituminous substrate with two 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 and Downspouts

Part 1 - General

1.01 Section Includes

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

Work Includes: Shop fabricated, prefinished aluminum steel gutters and downspouts.

1.02 Related Sections

Section 07 41 00 – Standing Seam Metal Roofing
Section 07 60 00 – Flashings and Sheet Metal
Section 07 63 00 – Vented Roof Edge Fascia

1.03 Submittals

Shop drawings showing layout, profiles, method of joining, anchorage details, etc

1.04 Warranty

Provide manufacturers 20 year written guarantee covering film integrity, fading, chalking.

Part 2 – Products

2.01 Materials

Prefinished Aluminum: 0.063-inch aluminum, commercial quality, primed and finished one side with Kynar based fluropolymer coating. Provide strippable plastic film on face.

1. Peterson Aluminum Corporation "Pac-Clad".
2. Firestone's "Una-Clad".
3. Vincent Metals 'ColorKlad'
4. Metal Era, Inc.
5. Approved equal

2.02 Components

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

Fabricate gutters and downspouts to profiles indicated on drawings.

Field measure site conditions prior to fabricating work.

Hem all exposed sheet metal edges.

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.

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
Kynar 500 paint.

Color: Match Peterson Aluminum 'Colonial Red'

Part 3 – Execution
3.01 Installation
Install gutters, collector heads and downspouts in accordance to manufacturer's instructions.

Seal moving joints in metal work with elastomeric joint sealants, complying with requirements specified in Division 7 Section "Joint Sealants."

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

1.02 Summary
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:

Section 07 92 00 – Joint Sealers
Division 22 – Plumbing: Pipe penetrations through fire rated partitions
Division 23 – HVAC: Pipe and duct penetrations through fire rated partitions
Division 26 – Electrical : Conduit penetrations through fire rated partitions

1.04 System Performance Requirements

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.

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.

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.

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.

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.

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

General: Submit the following according to Conditions of Contract and Division 1 Specification sections.

Product data for each type of product specified.

1.06 Quality Assurance

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.

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

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

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.
9. Approved equal

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
        5.) Approved equal
    b. Insulated metal pipes (sleeved or unsleeved):
        1.) Tremco Tremstop 1A
        2.) Hilti FS-One.
        3.) AD Firebarrier Silicone.
        4.) Rectorseal "Metacaulk 1000
        5.) Approved equal
    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
        5.) Approved equal
    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+"
5.) Approved equal

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
   5.) Approved equal
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"
   5.) Approved equal
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

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

Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements

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.

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

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.

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.

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

General: Comply with the "System Performance Requirements" article in Part 1, with ASTMC 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

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.

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.

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

Do not proceed to enclose firestopping with other construction until work has been inspected by authorities having jurisdiction, if required.

Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.05 Cleaning

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.

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 Scope of Work

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

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 expansion 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 Submittals

Manufacturer’s product data for type of sealant proposed for each application.

Samples of manufacturer's standard range of colors.

Test reports for joint sealants evidencing compliance with requirements.

Part 2 – Products

2.01 Manufacturers

1. Dow Corning Corporation
2. Tremco
3. Pecora Corporation
4. Sonneborn Building Products Chem Rex Inc.
5. Approved equal

2.02 Materials

Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing, field experience, and manufacturers recommendations and written specifications.

Colors: Provide colors indicated for exposed joint sealants or, if not indicated, as selected by architect from manufacturer's full range for this characteristic.

Elastomeric Sealant Standard (for exterior use): Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated, complying with ASTM C 920 requirements.

1. Multi-Part Nonsag Urethane Sealant for Use NT: Type M, Grade NS, Class 25, and as follows:
   a. Uses NT, M, A, and O.
   b. Tremco "Dymeric 511" or equal.
2. Multi-Part Nonsag Urethane Sealant for Use T: Type M, Grade NS, Class 25, and as follows:
   a. Uses T, M, A, and O.
   b. Tremco "THC-900/901" or equal.

Acrylic Sealant: (Interior Use - for control or expansion joints) Manufacturers standard one-part non-sag, solvent-release-curing, acrylic terpolymer sealant complying with ASTM C 920 for Type S; Grade NS;

1. Uses NT, M, G, A, and O; except for selected test properties which are revised as follows:
   a. Heat-aged hardness: 40-50
   b. Weight loss: 15 percent
   c. Max. Cyclic movement capability: plus or minus 12-1/2 percent.
2. Use Tremco "Dymonic" Sonneborn NP-1, or Pecora "DYNATROL 1-XL" at control or expansion joints.
3. For typical interior use sealants complying with ASTM C834. Pecora AC 20 or Tremco Acrylic Latex 834.

Latex Sealant: ASTM C 834.

Traffic Grade Sealants: Sealing of horizontal expansion and control joints in exterior concrete walkways

1. ASTM C920--One-part self-leveling moisture curing, polyurethane sealant.
   a. Tremco THC-901
   b. Pecora Corporation 'Urexpan NR-201'

Sealant Backings, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

Type C: Closed-cell material with a surface skin.

Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

Primer: As recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

Part 3 – Execution

3.01 Installation

General: Comply with joint sealant manufacturer's instructions for products and applications indicated.

Sealant Installation Standard: Comply with ASTM C 790, C 804, C 962, C 1193.

Install exterior sealants when temperature is in the lower third of temperature range recommended by sealant manufacturer.

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

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

Work Includes:

1. Hollow metal door frames
2. Follow metal borrowed lite frames.
3. Standard steel doors

1.02 Related Work Specified Elsewhere

Section 04 06 50 – Masonry Mortar and Grout: Grout filling of hollow metal frames
Section 04 20 00 – Unit Masonry: Preparation of masonry openings
Section 08 71 00 – Door Hardware
Section 08 80 00 – Glass and Glazing
Section 09 90 00 – Painting: Painting of hollow metal doors and frames

1.03 References

ASTM E152 – Methods of Fire Tests of Door Assemblies
DHI – Door Hardware Institute
NFPA 80 – Fire Doors and Windows

1.04 Quality Assurance

Conform to requirements of SDI-100.

Fire rated doors and frames to conform to ASTM E152.

1.05 Submittals

Shop Drawings: With manufacturer's standard details and specifications for steel doors and frames, submit shop drawings showing application to project, as required.

Standards: In addition to other specified requirements, comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" ANSI/SDI-100.

Part 2 - Products

2.01 Manufacturers

Hollow Metal Doors and Frames

1. Ceco Door Products, Brentwood, TN
2. Curries Company, Mason City, IA
3. Mesker Door Inc., Huntsville, AL

4. Pioneer Industries, Inc., Carlstadt, NJ
5. Steelcraft, Cincinnati, OH
6. Approved equal

2.02 Hollow Metal Doors And Frames

Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

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 in accordance to ASTM A 525, with A60 or G60 coating designation, mill phosphatized.

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.

Fire-Rated Assemblies: Provide units that display appropriate UL or FM labels for fire-rating indicated.

Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.

Shop Applied Primer:

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 and Frames

Fabricate units to be rigid, neat in appearance, and free from defects, warp or buckle.

Frames shall be all-welded construction. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible.

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."

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.

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 three 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

Install hollow-metal doors and frames in accordance to manufacturer's instructions and final shop drawings. Coordinate with masonry and stud wall construction.

1. Install frames in accordance to SDI-105.
2. Install fire-rated units in accordance to NFPA Std. No. 80.
3. Finish hardware is specified in Section 08 71 00.

Grout all hollow metal frames. Coordinate installation of electrical work routed through hollow metal door frames with electrical trade.

3.02 Tolerances (Doors and Frames)

Fit doors to frames and floors with clearances specified in ANSI/SDI-100.

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

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

Work Includes:

1. Prefinished Flush Wood Doors

1.02 Related Work

Section 08 11 13 – Standard Steel Doors and Frames
Section 08 71 00 – Door Hardware
Section 08 80 00 – Glass and Glazing

1.03 Quality Assurance

Quality Standards: Comply with NWWDA I.S.1 and AWI "Architectural Woodwork Quality Standards".

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

Shop Drawings indicating location, size, face material, and finishes of each door required.

Samples 1-0" square, of each type of core construction, face material and finish required.

1.05 Warranty

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

Subject to compliance with requirements, provide wood doors by one of the following:

1. Graham
2. Algoma Hardwoods, Inc.
3. Buell Door Company.
4. Eggers Industries.
5. Oshkosh
6. VT Industries
7. Weyerhaeuser Company
8. Approved equal

2.02 Door Types

General Wood Door Product Requirements: Provide doors with same exposed surface material on both faces and edges of each door, unless otherwise indicated.

Interior Solid Core Doors for Transparent Finish: As follows:

1. Faces: Red Oak, rift cut, 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.

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. and 90 min. labeled doors): Where required per Positive Pressure standards, provide fire doors with intumescent concealed behind ¼" matching hardwood stile edge.

Provide solid hardwood blocking with minimum screw pullout strength of 600 lbs. for attachment of all hardware. Through bolting of hardware is not acceptable. Where through bolting may be required by Underwriters Laboratory (UL) to maintain fire rating, solid hardwood blocking is still required.

2.03 Vision Lite Frames

Manufacturers

1. Air Louvers, Inc., Commerce, CA; Model VLF-EZ (single glazing)
2. Anemostat Door Products, Carson, CA; Model 'LoPro'
3. Approved equal

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 Finish

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

Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.

Install fire-rated doors in corresponding fire-rated frames in accordance to requirements of NFPA No. 80.

Align and fit door in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.

Prefit Doors: Fit to frames for uniform clearance at each edge.

Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

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 31 00 – Access Floor 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: Floor door access panels.

1.02 Related Work

A. Section 03 30 00 – Cast-In-Place Concrete: Floor slab blockouts

1.03 Submittals

A. Submit in compliance with Section 01 33 00 – Submittal Procedures
   1. SD-02 Shop Drawings: show profiles, accessories, location and dimensions.
   2. SD-03 Product Data: Provide manufacturer's product data for all materials in this specification.

1.04 Job Conditions

A. Verify that other trades with related work are complete before installing access floor doors.

1.05 Warranty

A. Manufacturer's Standard Warranty: Materials shall be free of defects in material and workmanship for a period of 5 years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electrical motors, special finishes and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

Part 2 - Products

2.01 Manufacturers

A. The design for the floor door is based on Bilco Company Type 'K'. Subject to compliance with requirements, provide a comparable product by one of the following:
   1. Acudor Products, Inc.
   2. Babcock Davis
   3. Nystrom Building Products
   4. Approved equal

2.02 Access Floor Door

A. Furnish and install where indicated on plans, pre-assembled, single leaf floor access doors set flush with concrete floor slab.
   1. Size: 24" x 24" pre-assembled from the manufacturer.

B. Performance characteristics
   1. Cover: Shall be reinforced to support a minimum live load of 150 psf with a maximum deflection of $1/150^{th}$ of the span.
   2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

C. Cover: Shall be ¼" (6.3 mm) aluminum diamond pattern plate.

D. Frame: Shall be extruded aluminum with strap anchors bolted to the exterior.

E. Hinges: Shall be specifically designed for horizontal installation and shall be bolted to the underside of cover.

F. Lifting mechanisms: Cam-action hinges shall pivot on torsion bars to provide smooth, easy and controlled over operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing.

G. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover.

H. Hardware:
1. Hinges: Cast steel cam-action hinges which pivot on torsion bars shall be provided.
2. Cover shall be equipped with a steel hold open arm that automatically locks the cover in the open position.
3. Cover shall be fitted with the required number and size of torsion bars.
4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
5. Hardware: Shall be zinc plated and chromate sealed. Type 316 stainless steel hardware is available for installation in corrosive environments.

I. Finished: Factory finish shall be mil finish aluminum with bituminous coating applied to the exterior of the frame.

Part 3 - Execution

3.01 Inspection

A. Verify that the vault access door installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.02 Installation

A. Coordinate exact location of floor slab block-outs with HVAC contractor for access to radiant flooring manifold locations.

B. Install floor access doors per manufacturer's instructions.

End of Section 08 31 00

Section 08 36 13 – Sectional Overhead Doors

Part 1 - General

1.01 Work Included

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

Section includes:

1. Electrically operated overhead sectional doors, insulated flush steel design.
2. Operating hardware and supports.

1.02 Related Work

Division 26 – Electrical: Power connections to operators.

1.03 Submittals:

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:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs.
3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
4. Programming features for keypad devices.

Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

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.

1.04 Performance Requirements

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:

Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.

Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 50,000 cycles.

1.05 Warranty

Provide manufacturer's standard one year warranty on defects in materials and workmanship, and five years from the date of installation on delamination of insulation from its interior and exterior skins.

Part 2 - Products

2.01 Manufacturers:

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 Co. 816R-26
3. Approved equal

2.02 Materials

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 (225 MPa) and a minimum G60 (Z180) zinc coating.

1. Steel Sheet Thickness: 27 gauge.
2. Exterior and Interior Section Face: Flat.

Fabricate door panels from a single sheet to provide sections not more than 24 inches (600 mm) high and nominally 2 inches (50 mm) 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

For insulated doors, provide door sections with continuous thermal-break construction, separating faces of door.

Enclose open section with not less than 16 gauge galvanized steel channel end stiles welded in place. Provide not less than 0.064-inch (1.6-mm) galvanized intermediate stiles, cut to door section profile, spaced at not more than 48 inches (1200 mm) o.c., and welded in place.

Reinforce bottom section with a continuous channel or angle complying with bottom section profile.

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.

Provide reinforcement for hardware attachment.

Insulation: Insulate inner core of steel sections with manufacturer's standard rigid cellular polystyrene or 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.

Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.

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.

Glazing: Provide 1/8" insulated double strength glass lites as illustrated on the overhead door elevations in the drawings.

2.03 Tracks, Supports, and Accessories

Tracks: Provide manufacturer's galvanized steel track system, sized for door size and weight, designed for lift type required and clearances field verified, and complying with ASTM A 653 (ASTM A 653M), for minimum G60 (Z180) zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches (50 mm) o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

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.

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.

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 sensor edge.
2. In addition, provide continuous flexible seals at door jambs for a weather tight installation.

2.04 Hardware

General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

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.

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- (75-mm-) diameter roller tires for 3-inch (75-mm) track and as follows:

Case-hardened steel tires.

Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

Chain Lock Keeper: Suitable for padlock.

Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.05 Counterbalancing Mechanism

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.

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.

Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.

Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.

Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.06 Electric Door Operators

General: Provide electric door operator equal to Overhead Door RSX® Commercial Operators, ¾ hp continuous duty motor, complete with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, integral gearing for locking door, and accessories required for proper operation.

Comply with NFPA 70.

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.

Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

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.

Door-Operator Type: Provide unit consisting of electric motor and the following:

Trolley or drawbar type, with V-belt primary drive, chain and sprocket secondary drive, and quick disconnect-release for manual operation.

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 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.

Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

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.

Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
    a. Self-Monitoring Type: Provide self-monitoring sensor designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door operates to close only with constant pressure on close button.
2. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    a. Provide pneumatically actuated automatic bottom bar.
        1) Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

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

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.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Installation

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.

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

Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

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

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 seven days' advance notice.

End of Section 08 36 13

Section 08 41 00 – Aluminum Entrances and Storefronts

Part 1 - General

1.01 Section Includes

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

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
3. Weatherstripping
4. Perimeter caulking

1.02 Related Sections

Section 08 71 00 – Door Hardware
Section 08 80 00 – Glass and Glazing
Section 10 71 13 – Exterior Sun Control Devices

1.03 Submittals

Product Data: Include fabrication methods, finishing, hardware, accessories and installation recommendations.

Shop Drawings: Include elevations, details, hardware mounting heights, anchorages, expansion provisions and glazing details.

Samples: Pairs of each finish, on 12-inch long section soft extrusions and on 6-inch square sheets.

1.04 Performance Requirements

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° F (67° C).
2. Wind Loading: Withstand uniform test pressure of 20 psf inward and outward when tested in accordance 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.

Fixed Framing Transmission Characteristics:

1. Air Infiltration: Not more than 0.06 CFM per sq. ft. when tested in accordance to ASTM E 283 at an inward test pressure differential of 6.24 psf.
2. Water Penetration: No penetration when tested in accordance 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 45 CRF when tested in accordance to AAMA 1502.
4. Thermal Transmittance (451-T): Not more than 0.65 BTU/(hr. x sq. ft. x deg.F) at 15 mph wind velocity when tested in accordance to AAMA 1503.

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 in accordance to ASTM E 283 at an inward test pressure differential of 1.567 psf.

2. Condensation Resistance: Not less than 48 CRF when tested in accordance 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 in accordance to AAMA 1503.

1.05 Quality Assurance
Manufacturer's Qualifications: 5 years experience in fabrication.
Installer's Qualifications: 5-years experience in installation.

1.06 Warranty
Manufacturer's Product Warranty: Submit as part of project closeout 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
For basis of design, the plans are based on Tubelite, Inc.

1. Entrance Doors: Standard Wide Stile
2. Doors 111A and 111B: Thermally broken equal to Tubelite 'Therml=Block Wide Style'
3. Storefront Framing: Based on Tubelite, Inc. 'T14650 Series', 2 inches by 6-1/2 inch thermally broken.
4. Acceptable Alternate Manufacturers
   e. Kawneer Co.
   f. US Aluminum
   g. EFCO
   h. Approved equal

2.02 Materials
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.

Fasteners: Aluminum, nonmagnetic stainless steel, or other noncorrosive material.

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.

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.

Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

Thresholds: Extruded mill finished aluminum ADA compliant threshold of width required for frame depth.

Glass and Glazing Materials: Comply with requirements of "Glass and Glazing" section.

2.03 Fabricated Components

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

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.

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.

Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.

Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator.

Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

2.04 Aluminum Finishes

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.

1. Finish: AAMA 605.2, Fluoropolymer Coating
    a. Color: Custom color red to match standing seam metal roofing per section 07 41 00.

2.05 Hardware

Hinges: Provide pin and barrel type continuous 14-gauge 304 stainless steel hinges with 0.25 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

Pulls: Provide entrance door manufacturer's standard 1" dia. x 10" (center to center) wire pull handle.

Push: 1-inch dia. bent bar with 90 deg. x 2-1/4 projection at both ends.

Threshold: Manufacturer's standard extruded aluminum threshold machined to fit door type, size and type of hinge. Thresholds shall be ADA compliant, ½" in height and beveled to the floor on both sides to provide easy access for wheelchairs and strollers.

Weatherstripping: Manufacturer's standard replaceable pile weathering or vinyl gasket.

Sweep: Manufacturer's standard vinyl sweep for mounting to bottom edge of door with concealed fasteners on a mounting strip.

Deadbolt: Adams Rite Maximum Security Deadlock MS 1850A, standard long throw bolt of 5-ply laminated steel.

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 Latch: Schlage AD-Series x 626 Sparta (No Substitutions)

2.06 Glass and Glazing Materials

Glass and Glazing Materials: As specified in Section 08 80 00.

2.07 Perimeter Caulking

One-part, low modulus, high performance, neutral curing, non-staining, 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

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.

Separate aluminum and other corrodible metal surfaces from sources of corrosion at points of contact with other materials.

Adjust operating hardware to function properly.

Clean system promptly after installation.

3.02 Hardware Schedule

HARDWARE GROUP AL-1
Each single aluminum door to have:
DR. 101A, 101B, 111A, 111B

1 Each	Continuous Hinge	Markar FM300 32D
1 Each	Push/Pull	
1 Each	Threshold	Manuf. Std. (see par. 2.05 above)
1 Each	Weatherstrip	Manuf. Std. (see par. 2.05 above)
1 Each	Sweep	Manuf. Std. (see par. 2.05 above)

End of Section 08 41 00

Section 08 71 00 – Door Hardware

Part 1 – General

1.01 Work Included

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

Section includes:

1. Furnish all finish door hardware listed in the hardware schedule specified herein, or required by the drawings.

1.02 Related Work

Section 06 20 00 - Finish Carpentry

Section 08 11 13 - Steel Doors and Frames

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.

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.D.A.-Americans with Disabilities Act.

ANSI A117.1 Specification for making facilities accessible to physically handicapped people.

NFPA 80 Standards for Fire Doors and Windows

NFPA 101 Life Safety Code

U.L. Building Material Directory

D.H.I. Recommended Locations for Architectural Hardware

Applicable State and Building Codes, including IBC 2000

1.04 Submittals

Submit five copies of a detailed hardware schedule, vertical format. Prepare under the supervision of an AHC, registered Architectural Hardware Consultant, and under provisions of Division One.

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. Resubmit five copies of the corrected schedule when required.

Keying Schedule: After receipt of approved hardware schedule, submit a copy of keying schedule as a result of a keying meeting between the owner and the Hardware Supplier.

Samples: If so directed by the architect, submit samples of finish hardware items for approval. Properly identify each sample as to make and number, and finish.

Templates: Furnish a copy of approved hardware schedule, along with applicable templates for factory-prepared hardware to each door and frame fabricator.

Electrical Hardware: Submit electrical specifications and applicable information to the electrical contractor after receipt of the approved hardware schedule.

1.05 Quality Assurance

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.

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

Deliver, store and handle in accordance to Division One. Mark each original container with a door number that corresponds to the approved hardware schedule for the installation location.

Receive, inventory and store hardware in a secure and dry environment: protect against loss and damage.

Report any shortages to the hardware supplier no later than 48 hours after receipt of delivery to the job site.

Stockpile items sufficiently in advance to ensure their availability.

Part 2 – Products

2.01 Acceptable Manufacturers

Products	**Specified**	**Acceptable**
Hinges	McKinney	Stanley, Hagar, PBB
Closers	LCN	Sargent, Dorma
Flush Bolts	Rockwood	DCI, Trimco, Ives
Locks and Latches	Schlage	Sargent, Best
Electric Cylindrical Locksets	Schlage	Sargent, Best
Electric Locks w/ Keypad	Schlage AD-Series	No substitutions
Push/Pull	Rockwood	Trimco, Hager
Protective Plates	Rockwood	Burns, Hager
Overhead Stops, Holders	Glynn Johnson	ABH, Dorma
Wall and Floor Stops	Rockwood	Trimco, DCI
Threshold, Sweeps and Weatherstrip	Reese	Pemko, National Guard

2.02 Hinges

Acceptable manufacturers and respective catalog numbers:

Description	PBB	Stanley	McKinney	Hager
Std. Wt. Plain Bearing Steel	PB81	F179	T2714	1279
Std. Wt. Ball Bearing Steel	BB81	FBB179	TA2714	BB1279
Std. Wt. Ball Bearing–nonferrous	BB21/BB51	FBB191	T4B3786	BB1168
Hvy. Wt. Ball Bearing Steel	4B81	FBB168	T4B3786	BB1168
Hvy. Wt. Ball Bearing-nonferrous	4B21/4B51	FBB179	T4B3386	BB1199

Hinges supplied must be tested and comply with ANSI/BHMA standard for consistency, wear and corrosion resistance.

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

Type: Furnish as indicated in hardware groups.

2.03 Flush Bolts

Acceptable manufacturers and respective catalog numbers:

Description	Rockwood	Ives	Trimco	DCI
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

Furnish a dustproof strike for all bottom bolts

2.04 Locks and Latches

Acceptable manufacturers and respective catalog numbers:

Description	Best	Schlage	Sargent
Heavy-Duty Mortise	45H	L9000	8200
Heavy-Duty Grade 1 Cyl.	93K	ND Series	10 Line

Furnish lever designs as indicated in groups.

Furnish lock types and functions as specified in the hardware schedule and as follows:

1. Provide 2 ¾" backset
2. Provide 2 ¾" x 1 1/8" T strike with a dust box for use in wood doors or frame.
3. Provide 4 7/8" x 1 ¼" 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. Lockets and cores to be of same manufacturer to maintain complete lockset warranty.

2.05 Exit Devices

Acceptable manufacturers and respective catalog numbers:

Description	**Von Duprin**	**Precision**	**Sargent**
Wide Stile Rim	98	2100	8800
Wide Stile Vert. Rod	9827	2200	8700
Wide Stile Conc Vert. Rod	9875	2800	8600
Wide Stile Mortise	9875	2300	8900
Narrow Stile Rim	35	2400	8500
Narrow Stile Conc Vert. Rod	3547	2600	8400

Furnish exit device types and functions as specified in the Hardware Schedule.

Lever handles supplied with exit devices shall match the design specified for locks/latches.

2.06 Pulls, Push Bars, Push/Pull Plates

Acceptable manufacturers and respective catalog numbers:

Description Rockwood TrimcoBurns

Supply product as listed in groups and equal to acceptable manufacturers

2.07 Door Closers

Acceptable manufacturers and respective catalog numbers:

Description	**Dorma**	**LCN**	**Sargent**
Heavy Duty Reg. Arm	8900	4041	350
Heavy Duty Parallel Arm	8900 SPA	4041 EDA	350 PED
Heavy Duty Stop Arm	8900DS	4041 Cush	350 PS

2.08 Low-Energy Automatic Operators

Acceptable manufacturers and respective catalog numbers (shall be included in the hardware package).

Description	LCN	Norton
Operator – Push Side	4640	6960
Operator – Pull Side	4630	6910
Hardwired Wall Switch	956	685
Wireless Wall Switch	957	574
Wireless Receiver	931	RFI

Provide arms, mounting plates, sizes, stops, and any other 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 the requirements of ANSI A159.19.

2.09 Protective Plates
Acceptable manufacturers: Rockwood, Trimco, Burns, Hager

All kickplate heights shall be as listed in groups and 2 inches less door width single doors and 1 inch less for pairs.

Thickness shall be 0.050" (16 gauge).

2.10 Overhead Stop/Holders
Acceptable manufacturers and respective catalog numbers:

Description	ABH	Dorma	Glynn Johnson
Heavy Duty Surface	9000	900	90
Heavy Duty Concealed	1000	910	100
Standard Duty Surface	4400	700	450
Standard Duty Concealed	4000	710	410

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
Acceptable manufacturers and respective catalog numbers:

Description	Rockwood	Hager
Wrought Convex Wall	407	232W
Wrought Concave w/Toggle	409	237W

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.

Wall stops shall not be mounted to casework, cabinet work, sidelights or equipment.

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
Acceptable manufacturers and respective catalog numbers:

Description	Reese	Pemko	National Guard
Threshold	5205	171A	425A
Sweep	323	315N	200N
Sweep	967	18133CP	OV633
Weatherstrip	970	45100CP	603
Weatherstrip	DS78	315CR	130N
Gasket	797B	588	1010

Where specified in groups, furnish the above products unless otherwise detailed.

2.13 Door Hardware Finishes
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

2.14 Keying
To be determined after consultation with owner and architect.

Part 3 - Execution

3.01 Examination
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

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.

Set units level, plumb and true to the line and location. Prepare and reinforce the attachment substrate as necessary for proper installation and operation.

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.

If manufacturers' instructions do not call out a mounting location, refer to the Door and Hardware Institute's publication Recommended Locations for Architectural Hardware.

Delivery to the owner, one complete set of installation and adjustment instructions, as well as all tools that were furnished with the hardware.

3.03 Adjustment and Cleaning

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.

Instruct the owner's personnel in the proper adjustments of the hardware as needed.

Clean and restore hardware to the original finish.

3.04 Hardware Schedule

Hardware Group 1

Each single aluminum door to have:

DR. 101A, 101B

1 Each	Exit Device	98Lx996L-Rx 17 x 630	Von Duprin
1 Each	Rim Cylinder	20-022 626	Schlage
1 Each	Door Operator	4630	LCN
1 Each	Wall Stop	409 32D	Rockwood
2 Each	Actuators	956	LCN

Continuous hinge, weatherstrip, sweep,and threshold by Aluminum Entrance supplier.

Hardware Group 2
Each single door to have:
DR. 101C

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Lockset	ND70PD x SPA 626	Schlage
1 Each	Door Closer	4040 CUSH	LCN
1 Each	Kick Plate	16”x 2” LDW 320	Rockwood
1 Each	Smoke Seal	797B	Reese

Hardware Group 3
Each pair of doors to have:
DR. 102A and B, 116B and C

6 Each	Butts	TA2714-26D NRP 4.5 X 4.5	McKinney
1 Each	Lockset	ND80PD x SPA 626	Schlage
2 Each	Door Closer	4040 CUSH	LCN
1 Set	Flush Bolts	550 26D	Rockwood
1 Each	Smoke Seal	797B	Reese

Hardware Group 4
Each single door to have:
DR. 103,107A, 107B, 115

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Lockset	ND 70PD x SPA 626	Schlage
1 Each	O.H. Stop (DR. 103 107A and 107B)	GJ450S x 652	Glynn Johnson
1 Each	Wall Stop (DR. 115)	409 32D	Rockwood

Hardware Group 5
Each single door to have:
DR. 104,105,106

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Privacy Set	ND40S x SPA 626	Schlage
1 Each	Closer	4010 REG	LCN
1 Each	Wall Stop	409 32D	Rockwood

Hardware Group 6
Each single door to have:
DR. 110A, 110B, 114

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Lockset	ND70PD x SPA 626	Schlage
1 Each	O.H. Stops (DR. 110A)	GJ4505x626	Glynn Johnson
1 Each	Wall Stop (DR. 114)	409 32D	Rockwood
1 Each	Floor Stop (DR. 110B)	438	Rockwood

Hardware Group 7
Each single door to have:
DR. 113

3 Each	Butts	TA2714-26DNPD 4.5 X 4.5	McKinney
1 Each	Lockset	ND50PDxSPA 626	Schlage
1 Each	Wall Stop	409 32D	Rockwood

Hardware Group 8
Each single door to have:
DR. 117A, 117D

3 Each	Butts	TA2314-26DNPD 4.5 X 4.5	McKinney
1 Each	Electric Lockset	AD-200-CY-70-MTK-SPA-PD	Schlage
1 Each	Closer	4110 CUSH	LCN
1 Each	Kickplate	16”x 2” LDW 32D	Rockwood
1 Each	Weatherstrip	815A	Reese
1 Each	Sweep	323A	Reese
1 Each	Threshold	S40SA	Reese

Hardware Group 9
Each single door to have:
DR. 117B, 117C

3 Each	Butts	TA2714-26D 4.5”x4.5”	McKinney
1 Each	Lockset	ND80PD x SPA 626	Schlage
1 Each	Closer	4110 CUSH	LCN
1 Each	Kickplate	16’ X 2’ LDW 32D	Rockwood
1 Each	Weatherstrip	815A	Reese
1 Each	Sweep	323A	Reese
1 Each	Threshold	S40SA	Reese

Hardware Group 10
Each single door to have:
DR 109A

3 Each	Butts	TA2714-26D 4.5 x 4.5	McKinney
1 Each	Electric Lockset	ND96PDEU	Schlage
1 Each	Power Transfer	EPT2	Von Duprin
1 Each	Power Supply	505-ULAC-KLC	Schlage
3 Each	Push Button Switch	621AL-AA-L2	Schlage
1 Each	Door Closer	4110 CUSH	LCN
1 Each	Kick Plate	16”x 2” LDW 320	Rockwood
1 Each	Floor Stop	442	Rockwood

Hardware Group 11
Each single aluminum doors to have:
DR. 109B

2 Each	Spring Hinges	1552-26D 4.5”x 4.5”	McKinney
1 Each	Edge Guard	EG341	McKinney
1 Each	Floor Stop	442	Rockwood

Hardware Group 12
Each single aluminum door to have:
DR. 111A, 111B

1 Each	Electric Lockset	AD-200-993R-70-MTK-SPA-PD	Schlage
1 Each	Exit Device	98EO 630	Von Duprin
1 Each	Door Closer	4110 EDA W/18 DROP PLATE	LCN
1 Each	Continuous hinge, weatherstrip, sweep, and threshold by aluminum supplier		

Hardware Group 13
Each single door to have:
DR. 112

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Electric Lockset	AD-200-CY-70-MTK-SPA-PD	Schlage
1 Each	Door Closer	4110 CUSH	LCN
1 Each	Kick Plate	16” x 2” LDW 320	Rockwood
1 Each	Smoke Seal	797B	Reese

Hardware Group 14
Each single door to have:
DR. 116A

3 Each	Butts	TA2714-26D 4.5 X 4.5	McKinney
1 Each	Lockset	ND 80PD x SPA 626	Schlage
1 Each	Closer	4110 CUSH	LCN
1 Each	Smoke Seal	797B	Reese

Hardware Group 15
Each single door to have:
DR. 001A, 001B

3 Each	Butts	TA2714-26D 4.5 x 4.5	McKinney
1 Each	Lockset	ND 80PD x SPA 626	Schlage
1 Each	Wall Stop	409 32D	Rockwood

End of Section 08 71 00

Section 08 80 00 – Glass And Glazing

Part 1 – General

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

Glass and glazing for sections referencing this section for products and installation.

1.02 Related Sections
Section 08 11 13 - Standard Steel Doors And Frames
Section 08 14 16 – Flush Wood Doors
Section 08 41 00 – Aluminum Entrances

1.03 References
Glazing Standard: Comply with GANA "Glazing Manual" and FGMA "Sealant Manual".

Safety Glazing Standard: Comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

1.04 Submittals
Samples of each glass indicated, except for clear single pane units; and of each type of sealant or gasket exposed to view.

Certificates of compliance from glass and glazing materials manufacturers.

Part 2 - Products
2.01 Manufacturers
For basis of design, the plans are based on the PPG Solarban67.

Acceptable manufacturers include”
5. Viracon.
6. Pilkington Libbey-Owens-Ford.
7. Visteon Glass, Inc.
8. Oldcastle Glass
9. Approved equal

2.02 Flat Glass Materials
Primary Glass Products: Comply with ASTM C 1036 for the following:

Clear Float Glass: Type I, Class 1, Quality q3.

Uncoated Heat-Treated Glass Products: Comply with ASTM C 1048 and with manufacturing process indicated for the following:

Clear Tempered Float Glass: Kind FT, Condition A, Type I, Class 1, Quality q3.

2.03 Sealed Insulating Glass Units:

General: Comply with requirements of ASTM E 774 for Class A units and the following:

1. Clear Tempered Float Glass: Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Color: Clear
3. Visible Light Transmission: 54%
4. U-Values: Winter 0.29; Summer: 0.27
5. Solar Heat Gain Coefficient: 0.33
6. Low E coating on #2 surface

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.

1. Sealing System: Manufacturer's standard.
2. Spacer Material: Manufacturer's standard metal.

2.04 Fire Rated Glazing Materials (Impact Safety Rated)

Manufacturer: SGG Swissflam N2 / SGG Contraflam N2 as manufactured by Vetrotech Saint-Gobain NA, Auburn, WA Telephone 888-803-9533

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 and II)
6. STC Rating: Up to 44dB

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.

Fire Rating: Fire-rating listed and tested by Intertek Testing (WHI) for fire rating scheduled at opening locations in drawings, when tested in accordance 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 and 10C) (UL 263)

2.05 Spandrel Glass Units (Insulated Glass Units)

Outboard Lite: ¼-inch tinted float glass, fully-tempered.

Inboard Lite: ¼-inch clear float glass, fully-tempered with ceramic frit coat opacifier applied to #4 glass surface and Low 'E' coating on #3 surface.

2.06 Glazing Accessories

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).

Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

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.

2.07 Glazing Schedule

GL-1 : Tempered Glass
- Interior glazing at non-rated doors, sidelights, and borrowed lights
- ¼" thick, tempered, clear, unless otherwise indicated

GL-2 : Fire-Rated Glass
- Glazing located in fire rated doors and sidelites

GL-3 : Insulated glass units
- Glazing located in exterior doors and sidelites
- Sealed Insulating Glass Units consisting of:
  ¼” tempered glass, exterior pane
  ½” air space
  ¼” thick clear tempered glass, interior pane
  low-E coating

GL-4 : Insulated glass units
- Glazing located in exterior storefront framed walls
- Sealed Insulating Glass Units consisting of:
  ¼” tempered clear float glass, exterior pane
  ½” air space
  ¼” thick clear tempered glass, interior pane, with low-E coating

GL-5 : Insulated spandrel glass units
- Glazing located in exterior storefront framed walls, upper units
- Sealed Insulating Glass Units consisting of:
¼" tinted tempered glass, exterior pane
½" air space
¼" colored tempered spandrel glass, interior pane

Part 3 - Glass Installation (Glazing)

3.01 Examination

Verify that openings for glazing are correctly sized and within tolerance.

Glazing contractor shall confirm all field measurements of openings scheduled to receive glass prior to fabrication.

3.02 Preparation

Clean contact surfaces with solvent and wipe dry.

Seal porous glazing channels or recesses with substrate compatible primer and sealer.

3.03 Glazing

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.

Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

Protect glass from contact with contaminating substances resulting from construction operations; remove any such substances by method approved by glass manufacturer.

3.04 Cleaning

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

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

This section includes labor, materials, and equipment for the installation of factory glazed, translucent panel, including accessories, weep system and trim in accordance 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

Section 06 10 00 – Rough Carpentry: Treated wood blocking
Section 07 60 00 – Flashing and Sheet Metal: Sill flashing
Section 07 92 00 – Joint Sealants

1.03 Submittals

Submit shop drawings and color samples in accordance to Division 1, Submittals.

Test reports to be furnished by sandwich panel system manufacturer in accordance to Division 1, Submittals. 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)

Proof of regular, independent quality control monitoring under a nationally recognized building code review and listing program shall be submitted.

1.04 Quality Assurance

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 (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

Performance Requirements: The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1.05 Product Handling

Store translucent panels on the long edge, several inches above the ground, blocked and under cover to prevent warping in accordance to manufacturer's storage and handling instructions.

Part 2 - Products

2.01 Manufacturers

1. Kalwall Corporation
2. Major Industries
3. Approved equal

Manufacturers of translucent panels wishing to bid as a deductive alternate must submit a complete list of deviations from this specification at least 2 weeks prior to bid date and will be approved to bid as a deductive alternate in writing no later than 10 days prior to bid due date.

2.02 Materials – Translucent Panels

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.

Flammability – The interior face sheet shall be U.L. listed and have a flamespread rating no greater than 50 and smoke developed no greater than 250 when tested in accordance 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.

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 5 years outdoor South Florida weathering at 5 degrees facing south, determined by the average of at least 3 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.

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 ± 10% in thickness and be uniform in color.

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

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-inch. The I-beam grid shall be machined to tolerances of not greater than ± 0.002-inch. Thermal break shall be minimum 1-inch. 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.

Thermally Broken panels shall withstand 1200°F fire for minimum one hour without collapse or exterior flaming.

2.04 Adhesive

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".

Minimum tensile strength shall be 750 PSI by ASTM C-297 after 2 exposures to 6 cycles each of the aging conditions prescribed by ASTM D-1037.

Minimum shear strength by ASTM D-1002 after exposure to 5 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

Panels shall have a thickness of 2¾-inches with a "U" factor by NFRC certified laboratory of 0.10, light transmission of 8% and shading coefficient of 0.07. Complete system shall be NFRC certified.

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-inches at 30 psf in 10-feet by ASTM E-72.

Grid pattern shall be nominal 12" x 24" shoji.

The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

2.06 Battens And Perimeter Closure System

Closure system shall be extruded 6063-T6 and 6063-T5 thermally broken aluminum screw clamp-tite.

All battens and perimeter closures to be supplied with 300 series stainless steel screws (excluding final fasteners to the building).

All exposed aluminum to be architectural corrosion resistant finish which meets the performance requirements of AAMA 2604, color to be selected from manufactures standards.

Maintain continuous air barrier and vapor retarder throughout assembly in line with inside face of sandwich panel.

Provide flashing tabs at every batten and perimeter joint to prevent air infiltration.

2.07 Flexible Sealing Tape

Vapor retarding sealing tape shall be manufacturer's standard to prevent air infiltration into panel cells.

Part 3 - Execution

3.01 Preparation
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
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.

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.

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

Work Included: Provide metal studs, furring channels, and accessories as indicated on the drawings, as specified herein.

1.02 Related Sections
Section 06 10 00 – Rough Carpentry: Rough wood blocking within stud framing.
Section 07 21 16 – Blanket Insulation
Section 09 29 00 – Gypsum Board Assemblies

1.03 Submittals

Manufacturer's product information and installation instructions.

Submit shop drawings of prefabricated work indicating component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.

1.04 References

ASTM C 645 – Standard Specification for Nonstructural Steel Framing Members, 2000.

ASTM C 754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

ASTM C 1513 – Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

AISI Specification for the Design of Cold-Formed Structural Members.

AISI – Standard for Cold-Formed Steel Framing General Provisions

1.05 Delivery, Storage and Handling

Store products in manufacturer's unopened packaging until ready for installation per requirements of ASTM C 645.

Part 2 – Products

2.01 Manufacturers

5. Dietrich Metal Framing, Miami, FL
6. Clark Steel Framing Systems, Middletown, Ohio
7. Nuconsteel (A Nucor Company), Denton, TX
8. Approved equal

2.02 Components

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.

Runner Track: Cold-formed galvanized steel in conformation with AISI Specifications for Design of cold-formed steel structural Members.

Thickness equal to stud thickness minimum or heavier per design required.

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 ½” deep “z” profile with ¾-inch 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-inch deep hat shaped corrosion-resistant framing component used to furr out masonry wall and ceiling assemblies.
3. Resilient Channels: Single leg, 25 gauge x ½-inch deep resilient channels.

2.03 Accessories

Bridging: 16 ga. corrosion-resistant galvanized steel U-shaped, ¾-inch wide channels with clip angles for attachment to studs.

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.

Touch-Up Paint: Provide stud manufacturer’s standard zinc rich, containing 95-percent metallic zinc.

2.04 Materials

Cold-Formed Steel: Complying with ASTM A 1003/A 1003M; unless indicated otherwise.

Galvanized Coating: G40 coating weight minimum, complying with ASTM C 645.

2.05 Fabrication

General: Framing components may be preassembled into panels prior to erecting.

Fabricate panels square, with components attached in a manner so as to prevent racking or distortion.

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.

Fasteners: Fasten components using self-tapping screws or welding.

Part 3 – Execution

3.1 Examination

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.

If substrate preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

3.2 Erection

Install cold-formed framing in accordance to requirements of ASTM C 745.

Framing Installation:

1. Erect framing and panels plumb, level and square in strict accordance with approved drawings.
2. Handle and left 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 in accordance 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.

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 ½" 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.

3.3 Protection

Protect installed products until completion of project.

Replace damaged metal stud framing members prior to hanging gypsum board.

End of Section 09 22 16

Section 09 29 00 – Gypsum Board Assemblies

Part 1 - General

1.01 Work Included

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

Work Includes

1. Gypsum Board and Joint Treatment
2. Gypsum Board Ceiling Suspension System
3. Acoustical Sound Attenuation Blanket Insulation
4. Drywall Moldings, Furring and Accessories

1.02 Work Included Under This Section But Specified Elsewhere

Section 06 10 00 – Rough Carpentry: Wood blocking
Section 07 21 16 – Blanket Insulation
Section 09 22 16 – Non-Bearing Metal Wall Framing
Section 09 90 00 – Painting

1.03 References

ASTM C36 – Gypsum Wall Board
ASTM C475 – Joint Treatment Materials for Gypsum Wallboard
ASTM C 1002 – Gypsum Board Screws
ASTM C514 – Nails for the Application of Gypsum Wallboard
ASTM C 840 – The Standard Specification for Application and Finishing of Gypsum Board
Gypsum Association publication GA 214-90: Recommended Specifications: Levels of Gypsum Board Finish
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

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.
4. Approved equal

2.02 Materials

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

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 ½ deep "z" profile with ¾" 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.
3. Resilient Channels: Single leg, 25 gauge x ½" deep resilient channels.

Steel Framing Components For Suspended Gypsum Board Ceilings

1. General: Provide components complying with ASTM C635. 2. Wire Hangers: Galvanized carbon steel, soft temper, prestretched, 12-gauge wire.
2. Suspension System
    a. Main Tees: Fire-Rated Heavy Duty classification, 144" long, with integral reversible splice with knurled face. 1½" face, 1.617" high.
    b. Cross Tees: 1½" high x 48" long with 1½" wide face.
    c. Wall Moldings: Single web with knurled face, 1" x 1½"

Trim Accessories: ASTM C 840: mfr'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.
4. Reveal Molding: "F" Reveal molding
    a. Fry Reglet Model No. DRMF-625-50
    b. Flannery, Inc., San Fernando, CA
    c. Gordon, Inc., Bossier City, LA
    d. Approved equal

Gypsum Board Joint Treatment Materials: ASTM C 475 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.

Primer-Surfacer: USG 'TUFF-HIDE' vinyl acrylic latex based coating.

Miscellaneous Materials: As follows, recommended by gypsum board mfr:

1. Laminating Adhesives: Product recommended by gypsum board mfr.
2. Fastening Adhesive for Wood: ASTM C 557.
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.

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.
   e. Approved equal

Part 3 - Execution

3.01 Inspection

Verify that site conditions are ready to receive work and opening dimensions are as indicated on the shop drawings.

Beginning of installation means acceptance of existing surfaces.

3.02 Metal Furring Installation

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.

Space furring channels maximum 16 inches on center, not more than 2 inches from abutting walls. Continue furring channels from floor to 12 inches above finished ceiling at suspended ceiling locations.

3.03 Reveal Molding

Install aluminum "F" reveal molding where indicated on the drawings. Corners shall be neatly mitered.

Paint field applied fasteners to match color selected for aluminum reveal channel.

3.04 Ceiling Suspension System

Standard Reference: Install in accordance to ASTM C636, CISCA installation standards, and other applicable code references.

Install in accordance to manufacturer's current printed recommendations.

Component and Hanger Wire Installation: Main tees shall be spaced a maximum of 48 inches on center and supported by hanger wires spaced a maximum of 48 inches o.c. and as specified by UL Fire Resistance Directory attaching hanger wires directly to structure above. Cross tees shall be spaced per manufacturers' recommendations and as specified by UL Fire Resistance Directory.

Hanger wires are required within 12 inches on both sides of a pivoted splice clip. At least one hanger wire is required within 12 inches of the transition clip. Do not support wires from mechanical and/or electrical equipment.

3.05 Acoustical Sealant

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.

3.06 Installation (Gypsum Board)

Install and finish gypsum board to comply with ASTM C 840 and as follows:

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.

Screw gypsum board to metal framing and 'Z'-furring channels.

Screw both layers to supports where double-layer work is indicated or otherwise required.

Direct Bonding: Comply with mfr's recommendations where gypsum board is indicated to be directly bonded to substrate.

Do not bridge building expansion joints. Leave space of the width indicated between boards, and trim both edges for installation of sealant or gasket.

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.

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 HiLo 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.

3.07 Drywall Finishing

Apply joint tape and joint compound at joints between gypsum boards. Apply compounds indicated below at accessory flanges, penetrations, fastener heads and surface defects.

Install compound in three coats (plus pre-fill of cracks where recommended by mfr); sand between coats and after last coat.

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 mfr's directions.

Finish: Level 4 smooth finish (GA 214-96)

Primer-Surfacer:

1. Mix primer-surfacer coating as directed by manufacturer. Do not thin or intermix with any other product.
2. Apply primer-surfacer coating with airless spray equipment that meets the pressure range recommended by manufacturer for minimum Wet Film Thickness and coverage per gallon.
   a. Wet Film Thickness: 15-20 mils.

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
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.

ASTM INTERNATIONAL (ASTM)

ASTM C 1027(2009) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
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
ASTM C 648(2004; R 2009) Breaking Strength of Ceramic Tile
ASTM D 4068(2009) Chlorinated Polyethylene Sheeting for Concealed Water-Containment Membrane
ASTM E 2129(2005) Standard Practice for Data Collection for Sustainability Assessment of Building Products

GREEN SEAL (GS)
GS-36(2000) Commercial Adhesives

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)
GEIGreenguard Standards for Low Emitting Products

TILE COUNCIL OF NORTH AMERICA (TCNA)
TCA Hdbk (2008) Handbook for Ceramic Tile Installation

1.04 Submittals
A. Submit the following in accordance 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 Manufacturers
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'
      c. Approved equal

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.
   2. 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)
   1. Daltile 'Brixton™ Glazed Ceramic
   2. Size: 6" x 6"
   3. Color: 'Bone' BX01

B. Porcelain Floor Tile (PT-1)
   1. Daltile 'City View™'
   2. Size: 12" x 12"
   3. Color: 'Downtown Nite' CY04

C. Porcelain Tile Base (PT-2)
   1. Daltile 'City View™'
   2. Size: 6" x 12" Cove Base
   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 in accordance 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, in accordance 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 in accordance to manufacturer's recommendations.

C. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

D. Apply grout sealer as recommended by tile manufacturer.

End of Section 09 31 00

Section 09 51 00 – Acoustical Tile Ceilings

Part 1 – General

1.01 Work Included

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

Work Includes

1. Suspended metal grid ceiling system.
2. Acoustical tile
3. Accessories

1.02 Related Work

Division 23 – Mechanical: Air diffusion grilles in ceiling system
Division 26 – Electrical: Light fixtures in ceiling system

1.03 References

ASTM C635 – Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
ASTM C636 – Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
FS HH-I-521 – Insulation Blankets, Thermal Mineral Fiber, for Ambient Temperatures

1.04 Submittals

Submittals: In addition to product data for each type of acoustical panel and suspension system required, submit the following:

1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.

Attic Stock: Prior to project close-out, deliver replacement material to owner in the amount of 1 box for every 50 installed, or fraction thereof (2 boxes minimum), of each type, pattern, color or size.

1.05 Fire-Test-Response Characteristics

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

Manufacturer's 15-year limited warranty against sagging or warping due to humidity conditions.

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

Acoustical Panel Products:

1. Armstrong World Industries, Inc.
2. The Celotex Corporation
3. USG Interiors Inc.
4. Approved equal

2.02 Manufacturers – Suspension Grid

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
5. Approved equal

2.03 Materials

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.

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.

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:

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.

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'

Manufacturers: Armstrong #1732 *Fine Fissured* w/ Humiguard Plus or approved equivalent products from Celotex and USG subject to approval by architect.

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.

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 fur 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.

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.)

Wall Edge Molding: Provide metal channel type, with single flange exposed.

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:

1. 15/16 inch 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.

Part 3 – Execution

3.01 Installation

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.

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.

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 inches o. c. Mitre corner joints.

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.

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. Heterogeneous sheet vinyl flooring

C. Vinyl wall base

1.02 Related Sections

A. Section 09 31 00 – Tiling: Flooring Transition Strip

1.03 Submittals

A. Submit the following in accordance to Section 01 33 00 – SUBMITTAL PROCEDURES:

1. SD-03 Product Data: Manufacturer's product data and installation instructions for each type of resilient flooring.
2. SD-04 Samples: 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
      d. Approved equal

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. Color: Armstrong 'Graphite Gray 61'

Part 3 - Execution

3.01 Examination: Beginning of installation means acceptance of existing substrate and site conditions.

3.02 Preparation: Apply primer to concrete substrates as recommended by flooring manufacturer.

3.03 Installation: Comply with flooring manufacturer's recommendations for type(s) of materials, adhesives, project conditions, and intended use.

3.04 Cleaning: Clean floors and accessories after installation in accordance to flooring manufacturer's instructions.

End of Section 09 65 00

Section 09 68 00 – Carpeting

Part 1 – General

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

Section includes;

1. Modular carpet tile
2. Stitched carpet wall base with same pattern as modular carpet tile

1.02 References
ASTM E84 – Surface Burning Characteristics of Building Materials

1.03 Submittals
Submit Product Data for each type of carpet, and the following:

Samples two full tile samples illustrating color and pattern for each carpet material specified.

Manufacturer’s Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

Maintenance Data: Include maintenance procedures. Recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.04 Quality Assurance

Contractors Certification: Provide certification testifying installation contractor is certified by the Floor Covering Installation Board (FCIB).

1.05 Warranty

Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

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.

Chair pads must not be required for carpet warranty coverage.

Warranty shall be for a specifically defined non-prorated period of twenty years. “Lifetime” warranties are not acceptable.

Warranty shall not exclude carpet product installed on stairs provided it is properly installed and maintained.

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

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.

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.

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.

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

For basis of design, the plans are based on Interface 'Kamala'

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. The New Patcraft and Designweave
4. J&J Commercial
5. Approved equal

2.02 Materials

Modular Carpet Tile

1. Tufted texture loop
2. Antimicrobial Treatment: (AATCC 138 Washed) (AATCC 174 Parts 2 and 3)
3. Soil/Stain Protection: Protekt® with Duratech®
4. Size: 50 cm x 50 cm.
5. Total Thickness: .295 inch
6. Fiber System: Type 6,6 Nylon Antron Lumina®
7. Dye Method: 100% Solution Dyed
8. Pile Density: 7,886
9. Backing: GlasBac® Tile

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
4. Flame Spread: 25 or less per ASTM E 84.

Trowelable Underlayments and Patching Compounds: As recommended by the carpet manufacturer.

3000 psi minimum Portland cement based leveling compound and substrate primer in accordance to carpet manufacturers recommendations.

2.03 Carpet Color: 101587 'Saki'

2.04 Stitched Carpet Base

Provide matching 4-inch high stitched edge carpet base where indicated on the plans and Room Finish Schedule.

Part 3 – Execution

3.01 Examination
Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 feet, and are ready to receive work.

Verify that concrete floors are dry to a maximum moisture content of 7 percent and exhibit Negative alkalinity, carbonization, or dusting.

Beginning of installation means acceptance of existing substrate and site conditions.

3.02 Preparation
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.

Clean floors and apply min. 3000 psi. Portland cement based leveling compound and substrate primer if required, in accordance to flooring manufacturer's instructions. Start of laying flooring product will indicate acceptance of floor slab conditions.

Prohibit traffic from area until filler is cured.

Vacuum clean substrate.

Project Conditions: Comply with CRI 104, Section 6: "Site Conditions."

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:

Remove subfloor coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone.

Apply manufacturer’s recommended Primer Barrier Coating over entire surface.

3.03 Installation
Apply TacTiles at each corner along anchor rows and perimeter walls in accordance to manufacturer’s guidelines.

TacTiles must be applied under every cut tile and any adjoining tile to the cut tile. Install TacTile an any area that will be exposed to high foot traffic and/or heavy rolling traffic.

Vacuum carpet using commercial machine with face-beater element.

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 in accordance to manufacturers recommendations.

Remove and dispose of debris and unusable scraps.

Protection: Comply with CRI 104, Section 15: "Protection of Indoor Installation."

Apply stitched carpet base to al 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

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

1.02 Summary

This section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.

Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified in other sections.

Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be 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 supervising professional will select from standard colors and finishes available.

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.

Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished 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.

Related sections include the following:

1. Division 3 section "Cast in Place Concrete" for surface preparation of exposed interior concrete finishes.
2. Division 5 section "Metal Fabrications" for shop priming ferrous metal.
3. Division 6 section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
4. Division 8 section "Steel Doors and Frames" for shop priming steel doors and frames.
5. Division 9 section "Gypsum Board Assemblies" for surface preparation for gypsum board.

1.03 Definitions

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

Samples for initial color selection in the form of manufacturer's color charts shall be submitted to the supervising professional for color selection. Field samples on various surfaces to be finished may be requested by the supervising professional.

Maintenance data for each product specified, to include in Operating and Maintenance Manual specified in Division 1.

1.05 Quality Assurance

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.

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

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.

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.

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

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).

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).

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.

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

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

Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, products listed in the paint schedules.

Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

1. Devoe & Raynolds Co. (Devoe).
2. Glidden Co. (The) (Glidden).
3. Benjamin Moore & Co. (Moore).
4. PPG Industries, Inc. (PPG).
5. Pratt & Lambert, Inc. (P & L).
6. Mautz Paint Co. Industrial Division
7. Sherwin-Williams Co. (S-W)

2.02 Paint Materials, General

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.

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.

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.

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

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.

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.

Notify the supervising professional about anticipated problems using the materials specified over substrates primed by others.

3.02 Preparation

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.

After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

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.

Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

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 re-prime.
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 non-petroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

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.

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

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.

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.

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.

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.

Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

Items to be painted include: Piping and accessory items.

Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

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.

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

Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

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

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 supervising professional.

Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

Paint plywood equipment boards in their entirety prior to the installation of equipment. Coordinate this work with other trades.

3.06 Exterior Paint Schedule

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) Devoe: 13101 Mirrolac Rust Penetrating Metal Primer.
        2) Glidden: 5205 Glid-Guard Tank and Structural Primer, Red.
        3) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
        4) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
        5) P & L: S 4551 Tech-Gard High Performance Rust-Inhibitor Primer.
        6) S-W: Kem Kromik Metal Primer B50N2/B50W1
        7) Approved equal
    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) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
        2) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
        3) Moore: Impervo Enamel #133.
        4) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.
        5) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
        6) S-W: Industrial Enamel B-54 Series
        7) Approved equal

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) Devoe: 8502/8520 Mirrolac-WB Interior/Exterior Waterborne Flat DTM Primer and Finish.
    2) Glidden: 5205 Glid-Guard Tank and Structural Primer, Red.
    3) Moore: IronClad Galvanized Metal Latex Primer #155.
    4) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
    5) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
    6) S-W: Galvite Paint B50W3
    7) Approved equal
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) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
    2) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
    3) Moore: Impervo Enamel #133.
    4) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.
    5) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
    6) S-W: Industrial Enamel B-54 Series
    7) Approved equal

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) Devoe: 8502/8520 Mirrolac-WB Interior/Exterior Waterborne Flat DTM Primer and Finish.
        2) Glidden: 5205 Glid-Guard Tank and Structural Primer, Red.
        3) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
        4) PPG: 90-709 Pitt-Tech Primer.
        5) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
        6) S-W: Pro-Cryl Universal Water Based Primer B66-310
        7) Approved equal
    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) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
        2) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
        3) Moore: Impervo Enamel #133.

4) PPG: 6-282 Speedhide Interior/Exterior Gloss Oil Enamel.
5) P & L: S 4500 Series Tech-Gard Maintenance Gloss Enamel.
6) S-W: Industrial Enamel B-54 Series
7) Approved equal

3.07 Interior Paint Schedule

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) Devoe: 52902 Bloxfil 200 Interior/Exterior Latex Block Filler.
      2) Glidden: 5317 Ultra-Hide Block Filler, Latex Interior-Exterior.
      3) Moore: Moorcraft Interior and Exterior Block Filler #173.
      4) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
      5) P & L: Z 98 Pro-Hide Plus Latex Block Filler.
      6) S-W: Prep-Rite Blockfiller B25W25
      7) Approved equal
   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) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
      2) Glidden: UH 400 Ultra-Hide Alkyd Interior Enamel Undercoater.
      3) Moore: Moore's Alkyd Enamel Underbody #217.
      4) PPG: 6-855 Speedhide Interior Latex Enamel Undercoater.
      5) P & L: S/D 1012 Suprime "12" Interior Alkyd Wall Primer.
      6) S-W: Promar 200 Alkyd Semi-Gloss
      7) Approved equal
   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) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
      2) Glidden: UH 8400 Ultra Traditional Alkyd Semi-Gloss Enamel.
      3) Moore: Satin Impervo #235.
      4) PPG: 27 Line Wallhide Low Odor Interior EnamelWall and Trim Semi-Gloss Oil.
      5) P & L: S/D 5700 Series Cellu-Tone Alkyd Satin Enamel.
      6) S-W: Promar 200 Alkyd Semi-Gloss
      7) Approved equal

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) Devoe: 50801 Wonder-Tones Interior Vinyl Latex Primer-Sealer.
        2) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
        3) Moore: Regal First Coat Interior Latex Primer and Underbody #216.
        4) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
        5) P & L: Z/F 1004 Suprime "4" Interior Latex Wall Primer.
        6) S-W: PrepRite 200 Interior Latex Primer
        7) Approved equal
    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) Devoe: 34XX Wonder-Tones Interior Latex Eggshell Enamel.
        2) Glidden: 4100 Series Spred Ultra Eggshell Latex Wall and Trim Paint.
        3) Moore: Moore's Regal AquaVelvet #319.
        4) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
        5) P & L: Z/F 4000 Series Accolade Interior Velvet.
        6) S-W: ProMar 200 Interior Latex Eg-Shel B20 Series
        7) Approved equal

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) Devoe: None required.
        2) Glidden: Glidden Paste Wood Filler.
        3) Moore: Benwood Paste Wood Filler #238.
        4) PPG: None required.
        5) P & L: None required.
        6) S-W: Sher-Wood Natural Filler.
        7) Approved equal
    b. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.
        1) Devoe: 96XX WoodWorks Alkyd Interior Stain.
        2) Glidden: 1600 Series Woodmaster Oil Wood Stain.
        3) Moore: Benwood Penetrating Stain #234.
        4) PPG: 77-302 Rez Interior Semi-Transparent Stain.
        5) P & L: S-Series Tonetic Wood Stain.
        6) S-W: Oil Stain A-49 Series
        7) Approved equal

c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
    1) Devoe: 4900 WoodWorks Quick-Dry Clear Sealer.
    2) Glidden: 5035 Ultra-Hide Quick-Dry Sanding Sealer, Clear.
    3) Moore: Moore's Interior Wood Finishes Quick-Dry Sanding Sealer #413.
    4) PPG: 77-30 Rez Interior Quick-Drying Sealer and Finish.
    5) P & L: H-40 Sanding Sealer.
    6) S-W: Wood Classics FastDry Sanding Sealer B26V43
    7) Approved equal
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) Devoe: 4600 WoodWorks Alkyd Satin Varnish.
    2) Glidden: 82 Satin Sheen Woodmaster Polyurethane Clear Finishes Varnish.
    3) Moore: Benwood Satin Finish Varnish #404.
    4) PPG: 77-7 Rez Varnish, Interior Satin Oil Clear.
    5) P & L: H24 38 Clear Finish Gloss.
    6) S-W: FastDry Oil Base Varnish, Gloss A66-300
    7) Approved equal

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) Devoe: 13101 Mirrolac Rust Penetrating Metal Primer.
        2) Glidden: 5207 Glid-Guard Tank and Structural Primer,White.
        3) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
        4) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
        5) P & L: S 4551 Tech-Gard High Performance Rust Inhibitor Primer.
        6) S-W: Kem Kromik Metal Primer B50N2/B50W1
        7) Approved equal
    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) Devoe: 84XX Mirrolac-WB Interior-Exterior Waterborne High Gloss Enamel.
        2) Fuller: 213-XX AA Enamel Interior Acrylic Latex High-Gloss Enamel.
        3) Glidden: 6900 Series Lifemaster Pro Hi-Performance Acrylic Coating.
        4) Moore: Impervex Enamel #309.

5) PPG: 51 Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel.
6) P & L: Z/F 4400 Series Accolade Interior High Gloss.
7) S-W: ProMar 200 Interior Latex Gloss Enamel B21W201
8) Approved equal

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) Devoe: 13201 Mirrolac Galvanized Metal Primer.
      2) Glidden: 5207 Glid-Guard Tank and Structural Primer,White.
      3) Moore: IronClad Galvanized Metal Latex Primer #155.
      4) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
      5) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
      6) S-W: Galvite Paint B50W3
      7) Approved equal
   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) Devoe: 84XX Mirrolac-WB Interior-Exterior Waterborne High Gloss Enamel.
      2) Glidden: 6900 Series Lifemaster Pro Hi-Performance Acrylic Coating.
      3) Moore: Impervex Enamel #309.
      4) PPG: 51 Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel.
      5) P & L: Z/F 4400 Series Accolade Interior High Gloss.
      6) S-W: Indistrial Enamel B54YZ37
      7) Approved equal
2. Color: For interior piperails, handrails, guardrails, and steel tube curbs at inspection pits, paint safety yellow.

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.

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

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

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 Pit.
3. Application of high-performance coating cove base to concrete masonry wall surfaces in Inspections 117.
4. Adhesive backed slip-resistant stair nosing treads at concrete stairs to inspection pits.

1.02 Related Sections:

Section 03 30 00 – Concrete
Section 04 20 00 – Unit Masonry

1.03 Submittals

Product Data: Submit manufacturer's product data, including physical properties, chemical resistance, surface preparation and application instructions.

Submit manufacturer's standard warranty and applicator's warranty.

Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

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- (100-mm-) square samples for each color and finish.

1.04 Quality Assurance

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.

Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

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, supervising professional, 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

Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

Store and handle materials in accordance to manufacturer's instructions.

Part 2 - Products

2.01 Manufacturers

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

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.

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.

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

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 supervising professional 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

High-friction, slip-resistant tape, 2-inch wide x 60 ft. rolls, safety yellow, coated on the backside with a pressure-sensitive adhesive covered by a removable protective liner.

Manufacturer:

1. 3M™ Safety-Walk™ 500 Series
2. Safe Way Traction Pressure sensitive traction tape
3. Wooster Products, Inc., Flex-Tred anti-slip tape
4. Approved equal

Part 3 - Execution

3.01 Examination

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.

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.

Notify supervising professional about anticipated problems before using the coatings specified over substrates primed by others.

3.02 Preparation

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.

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 contaminates from cleaning process will not fall on wet, newly coated surfaces.

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.

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.

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

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, convector 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.

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.

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.

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.

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.

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

Prep and clean concrete stair tread surfaces as recommended by tape manufacturer.

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.

Test all adhesive strips and replace sections that fail to adhere properly to concrete substrate.

3.05 Cleaning

Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from project site.

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

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 supervising professional, 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

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

Section includes;

1. Porcelain Enamel Markerboards
2. Vinyl-Fabric-Faced Tackboards

1.02 Related Work

Section 06 10 00 – Rough Carpentry: Wall backing

1.03 Submittals

Shop Drawings: Include sections of trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

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

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.
5. Approved equal

2.02 Material

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° F (649° 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.
        1) Core: 3/8-inch-thick particleboard, ANSI A208.1, Grade 1-M-1.
        2) Backing Sheet: 0.015-inch-thick aluminum sheet.
        3) Laminating Adhesive: Moisture-resistant thermoplastic adhesive.
        4) Mounting Method: Continuous top hanger strips with clips at bottom edge.

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 in accordance to ASTM E 84. Color as selected by architect from manufacturer's standard colors.

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.

Fabrication: Laminate porcelain enamel facing sheet and backing sheet to core material with flexible, waterproof adhesive.

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.

Finishes: Comply with NAAMM "Metal Finishes Manual."

Class II Clear Anodized Finish: AA-M12C22A31.

Part 3 - Execution

3.01 Installation

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, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

Install units in locations and mounting heights indicated in accordance 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.

Coordinate job-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.02 Markerboard Break-In:
Clean in accordance to manufacturer's instructions. Break-in markerboards only as recommended by the manufacturer.

End of Section 10 11 00

Section 10 12 00 – Map Display Cases

Part 1 - General

1.01 Scope of Work
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

Work includes:
1. Prefabricated aluminum map display cases.
2. Brochure display rack

1.02 Related Sections
Section 04 20 00 – Unit Masonry: Block walls

1.03 Submittals
Submit shop drawings, technical data sheets and schedules.

Submit corner sample of display case in specified color finish for approval.

Contract Closeout Submittals: Maintenance Data: manufacturer’s cleaning and maintenance instructions covering both routine and long-term operations.

1.04 References
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.

1.05 Delivery and Storage

Ship materials including attachment devices carefully packaged to prevent surface damage. Include shop drawings to ensure correct installation and arrangement of all materials.

1.03 Warranty

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

Map Display Cases

1. Poblocki Sign Company, West Allis, WI: Model 'B' Poster Case Series
2. Aarco Products, Inc.
3. Nelson-Harkins Industries
4. Apco
5. Approved equal

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. Equivalent products from the following manufacturers will be accepted contingent on compliance with the product basis listed above.
   e. Magzineracks.com
   f. Braeside Display
   g. Siegel Display Products
   h. Approved equal

2.02 Materials

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 I clear with minimum 0.25" (6 mm) thickness.
4. Tackable Surface: ¼" thick linoleum grade cork with burlap backing.

Wall Mounted Brochure Holder

1. The rack includes sis (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" wide x 20" high acrylic backplate.

2.03 Fabrication

Map Display Case Cabinet:

1. Description: 6030-T5 extruded aluminum alloy in accordance to ASTM B221; minimum 0.090” thick for window frame panels, and horizontal mullions. Aluminum extrusion nitered and assembled with concealed corner angles.
2. Cabinet Profile: 2” x ½” x 1/8” channel framed aluminum case. Cabinet depth to be 2 inches.
3. Glazing: Minimum ¼-inch clear tempered glass in accordance to Section 08 80 00.
4. Door Profiles:
   a. Vestibule 101: Top hinged aluminum frame with continuous anodized 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 108: 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.

Mounting Method: Surface mounted to concrete masonry wall surfaces behind.

Cabinet Background Finish: ¼-inch thick linoleum grade colored cork at background over ¼” luan plywood. Finish and color to be selected by architect from manufacturer’s standard options.

Frame Finish: Provide custom color acrylic polyurethane finish on all exposed framing in color to match aluminum curtain wall specified under Section 08 44 00.

2.03 Display Case Schedule (Indicated On Plans As ‘Dc’)

Mark	Location	Width	Height	Access Panel
DC-1	Vestibule 101	72”	48”	Top hinged w/ hold-opens
DC-2	Public Lobby 106	36”	44”	Side hinged
DC-3	Vestibule 101	23”	20”	

Part 3 – Execution

3.01 Installation

Install map cases in accordance to shop drawings and manufacturer’s recommendations.

3.02 Cleaning, Protection and Repair

Clean display units of dirt, dust, and grease after installation.

Protect finished installation from damage from work of other trades, such as plastering, gypsum wallboard, painting, etc. Repair damaged work to satisfaction of architect or replace work at no additional expense to owner.

End of Section 10 12 00

Section 10 14 16 – Interior Room Signage

Part 1 – General

1.01 Scope of Work
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.

Work includes:
1. Interior room sign plaques
2. Die-cut vinyl letters and graphics
3. Dedication Plaque

1.02 References
ADA 101-336, Sections 4.30 – 4.30-5.

1.03 Submittals
Submit shop drawings indicating dimensions and text layout.

Room list with room names and numbers for review by architect.

Manufacturer's standard color list for selection by architect.

Sign plaque sample.

Part 2 – Products

2.01 Manufacturers
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.
11. Approved equal

2.02 Materials

Sign Frame: Square corner modular plastic molded frame, ½-inch deep, prepunched for screw mounting to wall substrate.

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-inch 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

Room Signs: Room name and number to be identified with 1-1/4-inch high 'Helvetica Medium' raised letters with corresponding Grade 2 Braille text.

1. Size: 8" x 8"

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-inch high lettering indicating 'DANGER CONFINED SPACE'.

2.04 Mounting Method

Signs to be furnished to the jobsite with factory applied double-face tape and pre-punched for mechanical attachment (min. 2 screws).

Part 3 – Execution

3.01 Installation

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.

All room signs shall be mounted at 60 inches above finished floor to centerline of the sign.

Apply die-cut vinyl lettering and graphics where directed by WisDOT personnel.

3.02 Room Plaque Sign Schedule

Qty.	Room Location	Room No.	Graphic/Text
1	Storage	102	Room Name and Room Number
1	Storage	103	Room Name and Room Number
1	Women's Toilet	104	Female Pictogram w/ Universal Accessibility Symbol
1	Men's Toilet	105	Male Pictogram w/ Universal Accessibility Symbol
1	Uni-Sex Toilet	106	Male/Female Pictogram w/ Universal Accessibility Symbol
1	Janitor	107	Room Name and Room Number
1	Office	113	Officer's Name / Room Number
1	Multi-purpose Room	114	Room Name and Room Number
1	Telecom	115	Room Name and Room Number
2	Mechanical Room	116	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

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

Work includes:

1. Individual cast aluminum lettered sign.
2. Cast aluminum numerals

1.02 Submittals

Product Data: Manufacturer's construction details.

Shop Drawings: Show plans and elevations, sections of typical members, anchors, reinforcement, layout and installation details. Include the following:

1. Message list for each sign; include wording and letter layout.
2. Setting drawings and templates for anchor bolt installation.
3. Full-size spacing templates for dimensional letters.

Samples for selection of color, pattern and surface texture. Show full range of colors available.

1. Aluminum: Each finish type and color.

Part 2 - Products

2.01 Manufacturers:
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
5. Approved equal

Aluminum Castings: Alloy and temper recommended for casting process used.

Fasteners: Concealed non-corrosive metal fasteners.

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.

Unframed panel signs: fabricate edges mechanically and smoothly finished as follows:

1. Corner Condition: Square.

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.

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.
   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

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.

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.

Projected Mounting: Mount at distance indicated from wall surface.

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 in accordance with 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 Resistence: Provide rigid vinyl that does not support fungal or bacterial growth as tested in accordance to ASTM G-21 and ASTM G-22.

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.
5. Approved equal

2.02 Materials

A. Snap-On Corner Guards (90 deg. and 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 mars and abrasions under impact. Extrusions shall securely snap over .070 aluminum retainer, mill finish yet retain shock-absorbing movement.

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 in accordance 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

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

Work Includes
1. Toilet room accessories
2. Janitor’s Closet Accessories

1.02 Submittals

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.

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.

1.04 References
International Building Code

Americans with Disabilities Architectural Guidelines (ADA)

Part 2 - Products
2.01 Manufacturers
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
5. Approved equal

2.02 Materials
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 keys to owner's representative and obtain receipt.

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: 3

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 and inside face of bar.
3. Gripping Surfaces: Manufacturer's standard nonslip texture.
4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.
5. Qty: See plans.

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: 3

Stainless Steel Shelves

1. Shelf shall be type-304, 18-gauge (1.2 mm) stainless steel with satin finish. Mounting brackets welled to shelf shall be 16-gauge (1.6 mm) stainless steel. Shelf shall be 5" wide with ¾" return edges. Front edge shall be hemmed for safe handling.
2. Lengths
   a. Toilet Rooms 104, 105, 106; 16" wide x 5" deep
   b. Inspections 117: 36" wide x 5" deep

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: 3

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

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: 3

Surface-Mounted Soap Dispenser (Inspections 117)

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.

Surface Mounted Paper Towel Dispenser (Multi-Purpose Rm 114 and Inspections 117)

1. Manufacturers
   a. Bobrick Model B-72860
   b. Bradley Model 2495
   c. Tork Hand Towel Roll Dispenser, Lever Auto Transfer, Model 84TR
   d. Approved equal

2. Description: Surface-mounted towel dispenser with lever-operated dispensing mechanism will provide an adjustable means to dispense a nominal 2-1/2", 4" or 5" of toweling per stroke. Toweling will only be dispensed with the downward

stroke of the lever. Unit shall accommodate one 8” wide paper towel roll and one 4” partial (stub) roll. 1-1/2” core diameter.

Mop / Broom Holder (Janitor’s Room 107)

1. Mop and broom holder shall be ype-304 stainless steel with satin finish. Unit shall be 24” long with three spring-loaded rubber cam holders.

Stainless Steel Clothes Hooks (Multi-Purpose Rm. 114)

1. Bobrick Model B-672
2. Bradley Model 9124
3. Hook shall be polished stainless steel surface mount contoured robe hook with 4” wide horizontal bar that provides two hooks. 22-gauge stainless steel on a concealed 16-ga. mounting bracket.

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: 3

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 in accordance 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, in accordance 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

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

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

Section 04 20 00 – Concrete Unit Masonry: Preparation of openings

1.03 Submittals

Manufacturer's product data

Shop drawings indicating wall-mounting conditions, opening requirements and installation accessories.

Part 2 -Products

2.01 Manufacturers

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.
6. Approved equal

2.02 Equipment

Fire Extinguishers: Provide fire extinguishers for each extinguisher cabinet and other locations indicated. Furnish matching units where shown in lockers or surface wall mounted. Extinguishers to be fully charged, tagged and dated.

Multipurpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10-lb. nominal capacity, in enameled steel container.

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.

Mounting Brackets: Provide brackets for extinguishers not located in cabinets.

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.

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.

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.

Identify bracket-mounted extinguishers with red letter decals spelling "fire extinguisher" applied to wall surface. Letter size, style, and location as selected by architect.

Door Style: Manufacturer's standard design.

1. Full-Glass Panel: 1/4-inch-thick clear acrylic.
   a. Silk screen lettering.

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.

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.

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).

Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturers standard 2-coat baked enamel finish, consisting of prime coat and thermosetting topcoat.

Comply with paint manufacturer’s instructions for application and baking to achieve a minimum dry film thickness of 2.0 mils.

Color and Gloss: As selected by architect from manufacturers standard choices for color and gloss.

Part 3 - Execution

3.01 Installation

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. Multi-tier evidence storage locker
   3. Provide fasteners and anchorage devices to install lockers provided under this section.
   4. Provide metal filler panels to fill between banks of lockers and adjacent construction.

1.03 Submittals

A. The following shall be submitted in accordance 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 manual specified in Division 1.

1.04 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 in accordance to manufacturer's instructions.

B. Body of Lockers
   1. Exterior sides, Tops, Bottoms, Tier Dividers and Fascia: 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.

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.

2.04 Locker Schedule

Symbol*	Location	Type	Size
LO-1	Corridor 112	Single-Tier	18" W x 18" D x 36" H
LO-2	Storage 103	Single-Tier	15" W x 15" D x 72" H
LO-3	Storage 103	5-Tier	15"W x 15"D x 72" H

Part 3 - Execution

3.01 Installation
A. Wall Installation
Securely anchor every locker to wall before use. Installation hardware to be determined based upon wall construction. Tie adjacent locker units by bolting at four points, two at top and two at bottom , using ¼ 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
Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

Section includes:

1. Safety net system for use in conjunction with the recessed floor inspection trenches in the Inspection Bays.

1.02 Related Sections

Section 05 50 00 – Metal Fabrications: Steel tube trolley assembly for safety netting attachment.

1.03 Submittals

Product data

Samples: Submit 36" long sample of netting complete with hemmed edge and grommets.

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

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

Deliver netting protected in waterproof wrapping and identified as "Inspection Bay Trench Netting". Store in dry area.

Part 2 – Products

2.01 Manufacturer

BayNets Safety Systems, Colchester, CT 06415 (Ph: 800-331-0731): BayNets™ 'BNS38 System', Approved equal.

2.02 Materials

Description: Provide two sets of bi-parting net systems.

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

Netting Components:

1. Provide quick-link connectors for attachment to steel tube trolley rails.

Part 3 – Execution

3.01 Preparation

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 Installation

Install per manufacturer's recommendations. Include all required clamps, hardware, cables, for a complete and functioning system.

Weld one cab-lug (cable attached) to the side wall of the bay in a horizontal position as high as possible. Weld one Cab-Lug (without cable) to the opposite end of the bay in a horizontal position. Repeat for opposite side of the bay.

Weld the mid-bay pad eyes to the side wall of the bay in-line with the corner cab-lugs. Space these evenly with no more than 15 feet between pad eyes. Attach a snap hook to each mid bay pad eye.

Unscrew both sides of turnbuckle to its limit, then attach the jaw end of the turnbuckle to the cab-lug (without cable). Repeat on each side.

Run the cab-lug attached cable assembly down the length of bay and through the mid-bay snap hooks. Repeat on each side. Place 3 cable clamps on the free end of the cable. Thread the cable through the turnbuckle, around the thimble and through the 3 cable clamps. Pull slack out of the wire and tighten one clamp to hold cable in place. Tighten and torque the three cable clamps to 45 ft-lb. Repeat with the other cable assembly.

Tighten each cable assembly at turnbuckle until the cable can be moved no more than 2 inches vertically at the midway point of the bay net.

Attach net to the cable using quick links along the two long sides every 15 inches on center. Use the aluminum rings on the net as a guide.

Install the largest snap hooks to each corner of the net.

Following installation, the entire safety net system should be checked for smooth operation. Adjust as necessary.

3.3 Demonstration

Train owner's designated personnel on procedures related to net operation, stowage, troubleshooting, servicing, and preventative maintenance.

Schedule training with owner with at least 7-day advance notice.

End of Section 10 60 00

Section 10 75 00 – Flagpoles

Part 1 – General

1.01 Scope of Work

Provide all materials, accessories and labor necessary for the installation of aluminum flagpoles as shown on the drawings.

1.02 Related Work (By Others)

Section 03 30 00 – Concrete Piers

Division 26 - Electrical Systems: Connection to pole mounted light fixtures.

1.03 Submittals

Manufacturer's product data and installation instructions.

Shop Drawings

Part 2 – Products

2.01 Materials

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.
8. Approved equal

2.02 Fabrication

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.

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

Cone Taper: Manufacturer's standard seamless, uniform, straight-line tapered section above a cylinder butt section.

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:

Finial ball, 8" aluminum w/gold anodized finish.

Interior stainless steel halyard, with plastic coated counterweight and sling.

Truck assembly, stainless steel, revolving, stainless steel ball bearings, non-fouling, finished to match pole.

Hand crank, removable type.

Flash collar, spun aluminum to match flagpole finish.

Light Fixtures: Bracket mounted 18" long x 6" diameter aluminum cylinders designed to accept 150 watt flood lamps for up lighting. Finish to match flagpole.

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: 5
2. State of Wisconsin flags
   a. Size: 4' x 6'
   b. Qty: 5

Part 3 – Execution
1.02 Installation:
As shown, complete and in accordance to manufacturer's instructions.

Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

Maximum variation from plumb: 1 inch.

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:
Applicable provisions of Division 1 shall govern the work under this section.

Work Includes

1. Motorized projection screens
2. Projector mounts
3. Flat screen monitor mounting frame

1.02 Related Work By Others
Division 26 – Electrical: Electrical supply for electric screens

1.03 Submittals: In addition to product data, submit the following:

Shop drawings showing screen dimensions, fabrication, installation details, and electric wiring details.

1.04 Quality Assurance
Motors for electric screens shall be certified by Underwriters Laboratory (UL), Inc. and shall bear UL label.

Part 2 - Products:

2.01 Projection Screens
Manual Pull-down Projection Screens

1. Manufacturers: For basis of design, the plans are based on the Da-Lite, Spiceland, IN: Advantage ® Manual with CSR.
   a. Equivalent products from the following manufacturers will be accepted.
      Draper
      Elite
2. Rollers: Provide rigid metal rollers with Controlled Screen Return to control the return speed of the screen surface back into the case.

3. Projection Screen
    a. Type: Manually operated, retractable projection screen.
        1) Installation method: Ceiling pocket mounted.
        2) Case: Top, front and back of case to be made of extruded aluminum. End caps to be of heavy gauge steel. Bottom of case to have removable access door. 3) Finish: White enamel paint.
        3) Permanently attach screen fabric to roller. Provide bottom of screen with metal rod in pocket.
        4) Viewing surface: Matte White
            a. Size: 4:3 ratio, 100” diagonal
            b. Provide with black masking borders.

2.02 Projector Mount

Manufacturers

1. Chief Model Security Mount #RPAA1
2. Peerless Model PMS Security Mount PSM UNV-W
3. Approved equal

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.

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

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:

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.
    d. Approved equal

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

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-inch 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

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.

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 in accordance to manufacturer.

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

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:

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

Work Includes

1. Defibrillator equipment

1.02 Related Work By Others

Division 26 – Electrical: Electrical supply

1.03 Submittals:

Submit product literature and specifications.

Part 2 - Products:

2.01 Defibrillator Equipment

Manufacturer:

1. Philips Heart Start FRx
2. Medtronic Physio Control LifePak 9P
3. Approved equal

2.02 Description

Defibrillator to have EASY 1-2-3 operation with built-in noninvasive pacing and user-friendly display.

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

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

Furnish and install window treatment at all rooms identified on the drawings, including all track systems, and mounting hardware necessary for a complete installation.

Window treatment will include the following:

1. Horizontal louver window blinds
2. Rolling fabric room darkening solar shades
3. Roller tinted film shades

1.02 References

ASTM E84 – Surface Burning Characteristics of Building Materials

1.03 Submittals

Samples two 12 inch long samples illustrating color and pattern for each horizontal blind material specified.

Shop drawings showing details of components necessary for a complete installation.

Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

Maintenance Data: Include maintenance procedures. Recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.04 Warranty

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.

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

Horizontal Louver Blinds (WT-1)

1. Graber, Middleton, WI
2. Hunter Douglas
3. Levolor Contract
4. Springs Window Fashions Division; Bali
5. Verosol USA, Inc.
6. Approved equal

Rolling Fabric Solar Shades (WT-2)

1. BTX Window Automation, Inc.
2. Draper Shade and Screen Co., Inc.
3. MechoShade Systems, Inc.
4. Approved equal

Rolling Tinted Film Solar Shades (WT-3)

1. Hunter Douglas Window Fashions
2. Nyson Shading Systems Ltd.
3. Sol-R-Veil
4. Approved equal

2.02 Materials - Horizontal Louver Blinds: WT-1 (See Drawing A904)

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; long edges returned or rolled; fully enclosing operating mechanisms 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)
Provide vinyl-coated polyester yarns consisting of 25% polyester, 75% PVC on polyester with 0% openness factor equal to Phifer Sheerwearve Style 7000.

Solar Shade Colors
Selected by architect from manufacturer’s standard color range.

Roller Tube: 2-inch dia. heavy-duty aluminum tube.

Lift Operation: Manual, top-locking cord lock.

2.04 Materials - Roller Tinted Film Shades: WT-3 (See Drawing A904)
Shade Material: Tinted mylar film

Selected from manufacturer’s standard range of colors.

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.

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.

Mounting Brackets: Galvanized or zinc-plated steel.

Fascia: L-shaped, formed steel sheet or extruded aluminum, long edges returned or rolled; continuous panel concealing front and bottom of solar roller, brackets, and operating hardware and operators; removable design for access. Finish to match color of curtainwall framing.

Lift Operation: Manual, top-locking cord lock.

Part 3 – Execution

3.01 Examination
Complete field measurements prior to fabrication.

3.02 Installation
Mount track assembly a recommended by manufacturer.

Install blinds

Test operation of blinds.
End of Section 12 20 00

Section 12 48 16 – Floor Grids and Floor Mats

Part 1 — General

1.01 Work Included
Applicable provisions of Division 1 shall govern the work under this section.

Section Includes
1. Aluminum frames floor grid and mat
2. Anti-fatigue mats

1.02 Related Sections
Section 03 30 00 - Concrete

1.03 References
American Society for Testing and Materials (ASTM)

ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.04 Submittals
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.

Submit shop drawings showing layout and types of [mats] [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.

Submit one 12" x 12" sample of the specified system.

1.05 Delivery, Storage and Handling
Deliver [floor mat system] [floor grid system] to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.

Store components in original containers in a clean, dry location.

1.06 Warranty
Submit manufacturer's warranty that materials furnished will perform as specified for a period of not less than two years for floor grids and not less than three years for floor mats when installed in accordance to manufacturer's recommendations.

Part 2 — Products

2.01 Acceptable Manufacturers
Floor Grids (MAT-1)

1. Balco, Inc., Wichita, KS 67217: FGLP Series
2. Pawling Corp., Wassaic, NY
3. Construction Specialties
4. Approved equal

Anti-Fatigue Mats (MAT-2)

1. R.C. Musson Rubber Company: 'Sof-Spun Vinyl Sponge Mats'
2. 3M
3. Mats Inc. 'Cushion Eze'
4. Approved equal

2.02 Materials – Floor Grids

Floor Grid Systems:

1. Tread rails: ASTM B221, alloy 6005-T6.
2. Continuous vinyl hinges: Flexible P.V.C.
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.

Inserts: Two part epoxy combined with aluminum oxide grit.

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.

Color: Balco 'Earth Brown' or as selected from approved alternate manufacturers.

2.03 Materials – Anti-Fatigue Mats

3/8-inch thick closed cell sponge vinyl edge perimeter.

Surface: Embossed pebble surface.

Size (cut from roll goods)

Area	Size	Qty.
Operations 111	72" x 36"	2
Operations 111	36" x 36"	1

Color: Selected by architect from manufacturer's standard range of colors.

2.04 Fabrication – Floor Grids

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 be abrasive.
4. Fabricate abrasive treads of [one solid] [two parallel solid] line(s) of abrasive.
5. Provide necessary and related parts, devices, anchors and other items required for proper installation.

Provide components in single size where possible; minimize site splicing.

1. 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.
2. Frame, aluminum pan and I-beams shall be shop fabricated as an assembled unit for installation in the field.

Shop assemble components and package with anchors and fittings.

2.04 Finishes – Floor Grids

Aluminum

1. Tread rails, "U" channels: Clear Anodized
2. Embedded Frames: Shop coating of clear acrylic.

Abrasive: Specify color selected from standard abrasive colors.

2.05 Floor Grid Schedule

Room	**Size (Nominal Dimensions)**
Vestibule 101	14' – 0" long x 4'- 0" wide
Operations 111	3'- 0" long x 6'- 0" wide

Part 3 — Execution

3.01 Examination

Contractor shall verify that field measurements and recessed dimensions are as shown on shop drawings prior to releasing materials for fabrication by the manufacturer.

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

Install floor grid system in accordance to the governing regulations, the industry standards applicable to the work and the manufacturer's written installation instructions.

Work shall be aligned plumb, level, and, where required, flush with adjacent surfaces.

Carpet and Vinyl shall be positively locked into tread rails.

Anchors shall be spaced at 24 inches o.c.

3.03 Adjusting and Protection

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.

Advise the contractor of procedures required to protect the finished work from damage during the remainder of the construction period.

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, in accordance to the contract requirements.

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 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 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.

C. Verify storage areas with the prior to delivery. Verify delivery route and building access prior to fabrication or installation.

D. 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.
   1. Tables: Special T Tables
   2. Pedestals: Great Openings
   3. Task Chairs: 9 to 5 Seating
   4. Desks: Lacasse
   5. Bookcase: Lacasse

C. All products must have a minimum of a 15 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**: Not used

B. Tables: **F-2**
   1. Manufacturer: KI "Barron" Table - 60"W x 30"D x 29"H, 74P Edge, T-Base, HPL Surface and Powder-coated Base.
   2. Model: B255F-74P
   3. Quantity: 6
   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 11/8" 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 and 24"D x 15"W x 29"H.
2. Model: S7P/1524FFF
3. Quantity: 13
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 11/8" flanges on all edges, with the front edge having an additional return formation to further add strength. The front 11/8" 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 11/8" 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 11/4" 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 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, and 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 11/8" flanges on all edges, with the front edge having an additional return formation to further add strength. The front 11/8" 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 11/8" 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 11/4" 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 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.

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 and Height Adjustment.
2. Model: KI75/JR30
3. Quantity: 6
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 and Height Adjustment and Foot Rest Ring.
2. Model: KI74/JR30
3. Quantity: 6
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** and **F-7B**
1. Manufacturer: KI "Grazie" - Stackable, 4-Leg w/Casters (F-7), Armless, Fully Upholstered Seat and Back w/Pallas Grade 1 Fabric. Perfect Pivot Back Mechanism. Substitute
2. (F-7) Model: GLNAUBC (Qty: 10), and Model GSNAP (Qty: 2)
3. Total Quantity: 10 (F-7), 2 (F-7B)
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 ½" 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 cross member. 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
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.02 Summary
This section includes fixed seating with the following:

Floor mounted, molded-plastic stadium chairs (fixed audience seating).

1.03 Submittals
Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fixed audience seating.

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.

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.

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.

Maintenance Data: For fixed audience seating to include in maintenance manuals specified in Division 1. Include the following:

Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.

1.04 Quality Assurance
Installer Qualifications: Contractor with not less than five years of successful experience in installation of furnishing similar to those required for this project.

Source Limitations: Obtain each type of seating required, including accessories and mounting components, through one source from a single manufacturer.

1.05 Project Conditions

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.

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 Manufacturers

A. Wausau Tile, Wausau, WI; Site Furnishing Division
B. Custom Design Precast, Weston, WI
C. Petersen Manufacturing Co., Inc., Denison, IA
D. Approved equal

2.02 Site Furnishings Schedule

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.

B. Waste Container (Indicated as ‘SF-1’ on the ‘Fixture, Furniture And Equipment Plan, sheet A803.)
   1. Manufacturer: Wausau Tile Model ‘TF1029’
   2. Quantity: 3
   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.

C. Waste Container (Indicated as ‘SF-2’ on the ‘Fixture, Furniture And Equipment Plan, sheet A803.)
   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 Examination
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
Install seating in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions.

Install seating so moving components operate smoothly and quietly.

3.03 Adjusting
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
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.02 Summary
This section specifies general requirements for site furniture including the following:
1. Precast concrete waste containers
2. Precast concrete snuffers

1.03 Submittals
Product Data: Submit specifications, assembly, and installation instructions and general recommendations from manufacturers for each type of site furnishing required.

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
Manufacturer Qualifications: Manufacturer (material producer) with not less than five years of production of site furnishings similar to the items included under this section.

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

All shipping, storage and delivery costs for equipment furnished by the site furnishings supplier.

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

For basis of design, the plans are based on the site furnishing manufactured Wausau Tile, Wausau, WI; Site Furnishing Division.

Available Manufacturers

1. Wausau Tile, Wausau, WI; Site Furnishing Division
2. Custom Design Precast, Weston, WI
3. Petersen Manufacturing Co., Inc., Denison, IA
4. Approved equal

Equivalent products from alternate manufactures will be accepted contingent on compliance with specifications that meet or exceed the products specified in this section. Manufacturer's wishing to submit alternate products shall submit product data sheets and/or specifications.

2.02 Site Furnishings Schedule

Waste Container (Indicated as 'SF-1' on the 'Fixture, Furniture And Equipment Plan, sheet A803.)

1. Manufacturer: Wausau Tile Model 'TF1029'
2. Quantity: 3
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.

Waste Container (Indicated as 'SF-2' on the 'Fixture, Furniture And Equipment Plan, sheet A803.)

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
Set and level site furnishing equipment where indicated on the drawings.

3.02 Adjusting
Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

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 – Earthwork

Section 31 23 00 – Excavation and Fill

Part 1 – General

1.01 Scope of Work
Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

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.

The work under this section includes:
1. Preparing subgrades for slabs-on-grade.
2. Excavating 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.

1.02 Related Sections

Section 03 30 00 - Cast-in-Place Concrete for fine-graded granular material under vapor retarder.

Division 22 and 26 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

Section 31 22 19 – Finish Grading

Section 33 46 16 – Subdrainage Systems

If rock is encountered, refer to the standard specifications for procedures.

1.03 References

Geotechnical Soils Report prepared by Soils & Engineering Services, Inc., Madison, WI and dated July 24, 2002.

1.04 Definitions

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.

Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by supervising professional. Additional excavation and replacement material will be paid for as Common Excavation per approval by supervising professional.
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 supervising professional. Unauthorized excavation, as well as remedial work directed by supervising professional, shall be without additional compensation.

Fill: Soil materials used to raise existing grades.

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.

Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

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

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 supervising professional for testing prior to performance of the work of this section.

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

Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548, and acceptable to the Wisconsin Department of Transportation.

1.07 Project Conditions

Existing Utilities: Do not interrupt utilities serving facilities occupied by owner or others unless permitted in writing by supervising professional and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify supervising professional not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without supervising professional's written permission.
3. Contact utility-locator service for area where project is located before excavating.

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

General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

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.

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.

Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

Compacted Granular Base: Drainage Course under vapor barrier below slabs-on grade, 6-inch minimum.

Backfill and Fill: Satisfactory soil materials.

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 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

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.

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.

Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

Geotextile: Artificial fabric used as a separation-type interface between proof-rolled native soil and subgrade fill.

2.02 Geotextile Fabric

Manufacturers

1. TenCate Geosynthetics North America; Mirafi® 500X
2. Geo-Synthetics, Inc., Waukesha, WI; Soiltex™ ST200W
3. Approved equal

Description: Geotextile fabric shall be composed of high-tenacity polypropylene woven yarns, resistant to naturally encountered chemicals, alkalis, and acids.

2.03 Accessories

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

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

Provide erosion control during the entire project as specified in standard specifications and elsewhere in the building specifications.

3.02 Protection of Excavation

Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding area.

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

Explosives: Do not use explosives.

3.04 Excavation, General

Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation 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

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, 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 to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb the bottom of excavations that are intended to be the bearing surface.

3.06 Excavation For Utility Trenches

Excavate trenches to indicated gradients, lines, depths, and elevations.

Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

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 (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

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 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

Notify supervising professional when excavations have reached required subgrade.

If supervising professional determines that unsatisfactory soil is present, continue excavation to a depth determined by the supervising professional and replace with compacted backfill or fill material as directed.

Additional excavation and replacement material will be paid as Common Excavation per approval by supervising professional.

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.

Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by supervising professional.

3.08 Unauthorized Excavation

Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by supervising professional.

Fill unauthorized excavations under other construction or utility pipe as directed by supervising professional.

3.09 Storage of Soil Materials

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.

Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 Geotextile Placement

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

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

Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings; fill with concrete to elevation of bottom of footings.

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.

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.

Coordinate backfilling with utilities testing.

Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

Place and compact final backfill of satisfactory soil material to final subgrade.

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

Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

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

Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent 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 and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 Compaction of Backfills and Fills

Place backfill and fill materials in layers not more than 12 inches (300 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 8 inches (200 mm) in loose depth for material compacted by hand-operated tampers.

Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs and steps, compact each layer of backfill, engineered fill, or fill material at 95 percent.

3.16 Grading

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.

Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

Refer to Section 30 22 19 – Finish Grading for finish grading outside of building lines.

3.17 Drainage Course

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 percent 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 or less than 3 inches (75 mm) thick when compacted.

3.18 Draintile

Install drainage pipe where indicated on the drawings. Refer to the structural and plumbing plans for details.

3.19 Field Quality Control

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.

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.

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 supervising professional.

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 2000 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.

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

Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

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.

Scarify or remove and replace soil material to depth as directed by supervising professional; reshape and recompact.

3.21 Disposal of Surplus and Waste Materials

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

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 supervising professional 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 so notified the supervising professional, 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

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

1.02 Summary

This section includes the following:

1. Factory finished hinge gates.

Related sections include the following:

1. Section 03 30 00 - Cast-in-place Concrete
2. Section 04 20 00 – Unit Masonry

1.03 Submittals

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.

Provide templates for anchors and bolts specified for installation under other sections.

Samples for Verification: Submit sample of rail – picket joint with specified finish.

1.04 Quality Assurance

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.

Welding: Qualify 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.

Provide welding complying with American Welding Society Structural Welding Code for Steel, AWS D1.1.

Comply with applicable portions of Pipe Railing Manual, current edition, National Association of Architectural Metal Manufacturers (NAAMM).

1.05 Project Conditions

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.

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

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

Deliver fabrications, materials including accessories, anchor bolts, setting and bearing plates to the site at such intervals to ensure uninterrupted progress of the work.

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

Ameristar® Fence Products, Tulsa, OK; Montage II, Approved equal

Approved equal

2.02 Materials

Steel material for gate panels and posts shall conform to the requirements of ASTM A653/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-inch square
2. Stair Guardrail Gate: 3-inch square

Material for pickets shall be 1-inch 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 inches o.c. Fence posts and gate posts shall meet the minimum requirements recommended by the manufacturer for project conditions.

2.03 Accessories

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 DSB200
    b. Stair Guardrail Gate: Single gate latch; Ameristar Model DSB300.

Expansion Type Anchors

1. Hilti Kwik Bolt II, 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

Pickets, rails and posts shall be precut to specified lengths. Rails shall be pre-punched to accept pickets.

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.

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 exceed the criteria of ASTM F2408.

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.

Swing gates shall be fabricated using 1.75" x 14-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

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.

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.

Gate posts shall be set plumb.

Install hardware as recommended by manufacturer.

End of Section 32 31 19

END OF DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – Utilities

Section 33 46 16 – Subdrainage Systems

Part 1 – General

1.01 Section Includes
Applicable provisions of Division 1 shall govern the work under this section.

Work Includes
1. Building perimeter foundation subdrainage system.
2. Filter aggregate
3. Filter fabric.

1.02 Products Furnished But Not Installed Under This Section
Section 03 30 00 – Concrete: Installation of pipe sleeves for routing through foundations.
Section 31 23 00 – Excavation and Fill: Utility Trench Backfill

1.03 Related Sections
Section 31 23 00 – Excavation and Fill: Excavating subsoil for sub drainage system piping.

1.04 References
ASTM D2729 – Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.

1.05 Submittals
Submit product data.

1.06 Project Record Documents
Accurately record location of pipe runs, connections, cleanouts and invert elevations.

Part 2 – Products

2.01 Pipe Materials
Polyvinyl Chloride Pipe: ASTM D2729;

1. Provide perforated, 4 inch inside diameter rigid piping at perimeter footing drain tile locations. Corrugated plastic tubing will not be accepted.
2. Provide 6-inch diameter rigid, non-perforated piping at locations indicated on the drawings for conducting subdrainage water from collection point in Inspections 117 to sump at tunnel to static scale.

2.02 Filter Aggregate
Coarse Filter Aggregate: Clean, well graded, natural gravel, crushed stone, free from shale, clay, organic, materials or debris.

Fine Filter Aggregate: Clean, natural sand; free from silt, clay, organic matter or soluble materials; graded within the following limits:

2.03 Accessories
Pipe Sleeve: Continuous perforated plastic.

Filter Fabric: Water previous type, black polyolefin.

Part 3 – Execution

3.01 Examination
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.

Beginning of installation means acceptance of existing conditions.

3.02 Preparation
Hand trim excavations to required elevations. Correct over excavation with fill material.

3.03 Installation
Install and join pipe and pipe fittings in accordance to manufacturers' instruction.

Lay pipe to slope gradients noted on drawings with minimum pitch of 1/16-inch per foot.

Install coarse filter aggregate at sides and over and top of pipe. Provide top cover compacted thickness of 12 inches.

Place filter fabric over leveled top surfaces of filter aggregate cover prior to subsequent backfilling operations.

Connect to precast concrete sump basin.

3.04 Protection

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

58. SWEF Building, Plumbing, SPV.0105.15.

A Description

This special provision describes plumbing work for the SWEF building. The work shall be in accordance to the applicable plans and the following specifications.

B (Vacant)

C (Vacant)

D Measurement

The department will measure SWEF Building, Plumbing 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.0105.15	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

1.1 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 standpipe served ‘Limited Area Sprinkler System’ for the truck inspections bay (Inspections 117) serviced from a fire department connection located on the east wall of the Inspections area of the building.

1.2 RELATED SECTIONS
Section 21 05 29 – Hangers And Supports For Fire Suppression Piping And Equipment
Section 21 13 16 – Dry-Pipe Sprinkler System

1.3 STANDARDS
Abbreviations of standards organizations referenced in this and other sections are as follows:

AGA American Gas Association
ANSI American National Standards Institute
ASME American Society of Mechanical Engineers
ASPE American society of Plumbing Engineers
ASTM American Society for Testing and Materials
AWWA American Water Works Association
AWS American Welding Society
CGA Compressed Gas Association
CS Commercial Standards, Products Standards Sections, Office of Engineering Standards Service, NBS
EPA Environmental Protection Agency
FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
IAPMO International Association of Plumbing and Mechanical Officials
IEEE Institute of Electrical and Electronics Engineers
ISA Instrument Society of America
State of Wisconsin DSPS Safety and Buildings
MCA Mechanical Contractors Association
MICA Midwest Insulation Contractors Association
MSS Manufacturer's Standardization Society of the Valve and Fitting Industry, Inc.
NBS National Bureau of Standards
NEC National Electric Code
NEMA National Electrical Manufacturers Association
NFPA National Fire Protection Association
STI Steel Tank Institute
UL Underwriters Laboratories Inc.

1.4 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.

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.

1.5 SLEEVES AND OPENINGS

Refer to Division 1, General Requirements, Sleeves and Openings.

1.6 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.

1.7 CODES

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.

1.8 DESIGN CRITERIA

A. Design fire protection systems in accordance 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.

1.9 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 in accordance 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.

1.10 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 and 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 Superior Fire Department	1 copy

1.11 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

1.12 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.

1.13 RECORD DOCUMENTS

Refer to Division 1, Section 01 78 39 – Project Record Documents.

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

2.1 ACCESS PANELS AND DOORS

Coordinate the location of all access panels and doors with the Architect.

2.2 KEY BOX

A. The Fire Protection Contractor shall be responsible for obtaining and completing forms required by the City of Superior 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.

2.2 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, ¾” 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, ¾” 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, or approved equal.

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, W. H. Brady, or approved equal.

2.3 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 judgment 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.

2.4 NON-RATED PENETRATIONS:
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.

PART 3 - EXECUTI N

3.1 CUTTING AND PATCHING
Refer to Division 1, Section 01 78 39 – Execution Requirements for Cutting and Patching.

3.2 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.

3.3 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.

3.4 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 in accordance 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.

3.5 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 through 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.

3.6 SEALING AND FIRESTOPPING

A. Fire And/Or Smoke Rated Penetrations:

1. Install approved product in accordance 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:

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 and Supports for Fire Suppression Piping and Equipment

PART 1 – GENERAL

1.1 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.

1.2 RELATED WORK

Section 21 05 00 – Common Work Results For Fire-Suppression
Section 21 13 16 – Dry-Pipe Sprinkler System

1.3 REFERENCE

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

1.4 REFERENCE STANDARDS

MSS SP-58
MSS SP-69
NFPA 13: Installation of Sprinkler Systems (Latest prevailing addition).
NFPA 14: Installation of Standpoint and Hose Systems (Latest prevailing addition).
NFPA 20: Installation of centrifugal fire pumps (Latest prevailing additions).
UL: Underwriter's Laboratories Listed.
FM: Factory Mutual Approved

1.5 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.

1.6 SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures

B. SD-02 Shop Drawings

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.

1.7 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance to MSS Standard Practice SP-58 and SP-69 unless noted otherwise. Materials and application of pipe hangers and supports shall be in accordance 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

2.1 MANUFACTURERS
B-Line, anvil, Pate, Piping, Technology, Roof Products and Systems or approved equal.

2.2 STRUCTURAL SUPPORTS
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.

2.3 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
Carbon steel, adjustable clevis, standard with UL/FM approved size hanger rods. B-Line B3100, Anvil 260.

D. MULTIPLE OR TRAPEZE HANGERS
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
Carbon steel welded bracket with hanger. B-Line 3060 Series, anvil 190 Series. Steel channels with pipe clamps.

F. VERTICAL SUPPORT
Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

G. FLOOR SUPPORT
Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

H. 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 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, or approved equal.

2.4 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.

Pipe Size	Rod Diameter
Up to and Including 4”	3/8” or 9.5mm min.
5”, 6” and 8”	½” or 12.7mm min.
10” and 12”	5/8” or 15.9mm min.

2.5 BEAM CLAMPS

A. MSS SP-69 types 19 and 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, ½, 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.

2.6 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:

Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead, or approved equal.

2.7 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.

2.8 ANCHORS

A. Use welding steel shapes, plates, and bars to secure piping to the structure.

B. 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.

2.9 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

3.1 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 in accordance to standards of the American Welding Society.

3.2 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:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Copper	¾" through 1"	8'-0"	10'-0"
Copper	1-1/4" through 1-1/2"	10'-0"	10'-0"
Copper	2" through 3"	12'-0"	10'-0"
Copper	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"

3.3 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. Use method of securing the vertical risers to the building structure below in stairwell locations.

3.4 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. 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

1.1 SCOPE
Applicable provisions of Division 1 shall govern the work under this section.

This section contains specifications for fire protection pipe and pipe fittings for this project.

1.2 RELATED WORK
Section 21 05 00 – Common Work Results for Fire Suppression
Section 21 05 29 – Hangers and Supports for Fire-Suppression Piping and Equipment

1.3 REFERENCE
Applicable provisions of Division 1 govern work under this section.

1.4 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

1.5 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 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 Registered 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 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 in accordance 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.

1.6 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 contractor’s fire sprinkler state contractor's license.

1.7 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.

1.8 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.

1.9 WELDER QUALIFICATIONS

A. Welding procedures, welders, and welding operators for all building service piping to be in accordance 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

2.0 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.

2.1 COPPER PIPE:
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 1/2 the diameter of the main.

2.2 UNIONS AND FLANGES
A. 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.

B. 2" AND SMALLER COPPER:
ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

C. 2-1/2" AND LARGER:
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:
ANSI B16.24, Class 150 cast bronze flanges with raised face.

2.3 MECHANICAL GROOVED PIPE CONNECTIONS
Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Anvil, Star Fittings, or approved equal 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.

2.4 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, or approved equal.

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.

2.5 VALVES

A. The following description of valve types may or may not apply to the limited area sprinkler system described herein. Submit appropriate valve types with shop drawing submittals.

Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Victaulic, Viking, and Watts, or approved equal.

B. Ball Valves:

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.

C. Gate Valves:

1. 2" 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.
2. 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.

D. Butterfly Valves:

1. 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.

2. 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.

E. Supervisory / Tamper Switches

For O S and 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 and 6P enclosures.

F. Check Valves

1. 3" and smaller: Bronze body, threaded end, Y-pattern, re-grindable bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.
2. 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.
3. Provide 1/2" automatic drip drain on inlet of fire dept. connection check valve.

G. Spring Loaded Check Valves

1. 2" or smaller: Bronze body, threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, 175 psig, teflon seat unless only bronze available.
2. 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.

H. Drain Valves

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.

I. Double Check Valves

1. Manufacturers: Beeco, Cla-Val, Conbraco, Febco, Watts, Wilkinson, or approved equal.

2. 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.

J. Specialty Valves

Manufacturers: Central Sprinkler Corporation, Grinnell, Reliable, Star Sprinkler, Victaulic and Viking, or approved equal.

K. Alarm Check Valves

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.

L. Dry Pipe Valves
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.

M. Hose Outlet Valves
Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN, or approved equal.

2.6 CLASS I AND CLASS III SYSTEMS:
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.

2.7 CLASS II SYSTEMS:
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.

2.8 CLASS III SYSTEMS:
2-1/2" (chrome plated) brass angle valve, 300 psig, with red handwheel and National Standard male hose thread outlet, cap and chain.

2.9 FIRE HOSES
Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN, or approved equal.

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.

2.10 FIRE DEPARTMENT CONNECTION
Provide chrome finished 5” Storz FDC per requirements of the City of Superior Fire Department.

PART 3 - EXECUTION

3.1 GENERAL

Install pipe and fittings in accordance to reference standards, manufacturer's recommendations and recognized industry practices.

3.2 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.

3.3 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.

3.4 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 and assemble joint to socket stop. Apply flame to fitting until brazing alloy melts when placed at joint. Wipe excess alloy from joint.

3.5 WELDED PIPE JOINTS

Make all welded joints by fusion welding in accordance to ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used only for connections up to one-half the diameter of the immediate upstream piping..

3.6 THREADED PIPE JOINTS

Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.7 MECHANICAL GROOVED PIPE CONNECTIONS

Use pipe factory grooved in accordance to the coupling manufacturer's specifications or field grooved pipe in accordance to the same specifications using specially designed tools available for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance to the coupling manufacturer's specifications.

3.8 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.

3.9 UNIONS AND FLANGES

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 in accordance 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/pre-action 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

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Standards
- Quality Assurance
- Protection of Finished Surfaces
- Sleeves and Openings
- Sealing and Firestopping
- Equipment Furnished By Others
- Provisions for Future
- Submittals
- Codes

Request and Certification for Payment
Certificates and Inspections
Operating and Maintenance Data
Record Drawings

PART 2 - PRODUCTS
Access Panels and Doors
Identification
Sealing and Firestopping
Bedding and Backfill

PART 3 - EXECUTION
Excavation and Backfill
Sheeting, Shoring and Bracing
Dewatering
Rock Excavation
Surface Repair
Concrete Work
Cutting and Patching
Building Access
Equipment Access
Coordination
Identification
Lubrication
Sleeves
Sealing and Firestopping
Agency Training

Reference
Applicable provisions of Division 1 govern work under this section.

This section applies to all Division 22 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 and 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 and 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

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.

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.

Off Site Storage
Prior approval by DOT and the A/E will be needed. The contractor shall submit Storage Agreement Form AD-BDC-74 to DOT for consideration of offsite materials storage. Generally, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for offsite storage. No material will be accepted for offsite 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 DOT 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 DOT, 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 in accordance to Wis. Admin. Code Section ILHR 50.12. Deliver originals of these certificates to the Owner's Project Representative. Include copies of the certificates 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 DOT Project Representative for their use on this project.

PLUMBING SYSTEM DATA SHEET

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Unions			
Valves:			
Ball			
Butterfly			
Balancing			
Check			
Gate			
Curb Stop			
Other			
Pipe Specialties:			
Thermometers			
Press Gauges			
Strainers			
Building Penetrations			
Hangers and 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
- Dept. of Transportation 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 _8__ 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.

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, or approved equal.

Snap-Around Pipe Markers:
One-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, ¾" 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, or approved equal.

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, or approved equal.

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 Commerce Chapter 84 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:

Gradation for Bedding Sand

Sieve Size	% Passing (by Wt)
1 inch	100
No. 16	45 - 80
No. 200	2 - 10

Gradation for Crushed Stone Chip Bedding

Sieve Size	% Passing (by Wt)
1/2 inch	100
No. 4	75 - 100
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 judgment 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

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 saw cut lines parallel to existing joints, or parallel or perpendicular to pavement edges to form a neat patch. Carefully remove remaining pavement within the saw cut area. Leave existing base materials between the area disturbed by the work and the saw cut line undisturbed by the saw cutting, pavement removal, or pavement replacement processes.

Strip topsoil from area to be excavated, free from subsoil and debris, and store for later re-spreading.

At no time shall excavated materials be placed 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 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 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 ½ 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 1 pipe is laid in the trench and 3 feet larger than the combined outside diameter where 2 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 standard spec 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 standard spec 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 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 standard spec 601, Type D or L.

Sidewalk and Walkways: Non-reinforced concrete conforming to standard spec 602, thickness to match existing, cross slope of one-fourth inch per foot, scored into squares approximately equal to width.

Asphaltic Pavements: 4" thick crushed stone base course conforming to standard spec 304 (excluding 304.2.4) and two pass asphaltic pavement conforming to standard spec 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 20 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 in accordance 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.

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 in accordance 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, in accordance 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.

Agency Training
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 78 23.

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of six hours.

END OF SECTION 22 05 00

Section 22 05 13 - Common Motor Requirements for Plumbing Equipment

PART 1 - GENERAL

Scope
This section includes requirements for single and three phase motors that are used with equipment specified in other sections. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Operating and Maintenance Data
- Electrical Coordination
- Product Criteria

PART 2 - PRODUCTS
- Three Phase, Single Speed Motors
- Single Phase, Single Speed Motors
- Two Speed Motors
- Motors Used for Reduced Voltage Starting

PART 3 - EXECUTION
- Installation

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.

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 in accordance 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 in accordance to NEMA MG 1.

FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED

MOTOR HP	-----Open Drip-Proof Motors------ -------Nominal Motor Speed------- 1200 rpm	1800 rpm	3600 rpm
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

MOTOR HP	----Totally Enclosed Fan-Cooled---- -------Nominal Motor Speed------ 1200 rpm	1800 rpm	3600 rpm
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

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.

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 in accordance 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 in accordance 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 in accordance 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.

PART 1 - GENERAL
- Scope
- Related Documents
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Floor Drains
- Hub Drains
- Trench Drains
- Cleanouts
- Backwater Valves
- Subsoil Drain Tile Receivers
- Water Hammer Arrestors
- Backflow Preventers
- Wall Hydrants
- Hose Bibbs
- Trap Primer Valves
- Manholes and Catch Basins
- Safings
- Vent Flashings
- Interior Oil Interceptors

PART 3 - EXECUTION
- Installation
- Construction Verification Items
- Agency Training

Related Documents
Section 22 11 00 - Facility Water Distribution
Section 22 13 00 - Facility Sanitary Sewerage
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 DSPS 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.

PART 2 - PRODUCTS

Floor Drains
Manufacturer: Josam, Smith, Wade, Watts, Zurn, or approved equal.

FD-1: 4" min. enameled cast iron two piece body with double drainage flange, weep holes, reversible clamping adjustable collar, adjustable 6” round polished nickel-bronze strainer with threaded collar, bottom outlet. Zurn ZN-415-B.

FD-2: 4" cast iron body sani-flor receptor 8x8x6 with white acid resisting porcelain enamel interior and top, with aluminum anti-splash interior bottom dome strainer, bottom outlet. Zurn Z-1910-16

Hub Drains
Manufacturer: Josam, Smith, Wade, Watts, Zurn, or approved equal.

HD-1: 3“ min. cast iron hub section up 2” min. above floor level, with full-sized deep seal P-trap.

Trench Drains
Manufacturer: Aco, Josam, Neenah, Smith, Tyler, Watts, Zurn, or approved equal.

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, or approved equal.

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.

Exterior Paved Areas: 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.

Subsoil Drain Tile Receivers
Manufacturers: Josam, Schier, Smith, Zurn, or approved equal.

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, or approved equal.

ANSI A112.26.1, ASSE 1010; sized in accordance 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, or approved equal.

Hose Connection Vacuum Breakers: ASSE 1011, brass or bronze construction, EPDM diaphragm and seat, rated for 125 psig and 180^{o}F. Watts 8 (interior application).

Pipe Applied Atmospheric Type Vacuum Breakers: ASSE 1001, same size as pipe, brass or bronze construction, silicone disc, rated for 125 psig and 160^{o}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^{o}F. Watts 800M4QT

Wall Hydrants
Manufacturer: Josam, Smith, Wade, Watts, Woodford, Zurn, or approved equal.

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.

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, or approved equal.

Bronze body, O-ring seals, integral threaded outlet vacuum breaker, adjustable, in conformance with ANSI/ASSE 1018. PPP model P-1/P-2.

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, or approved equal.

Chlorinated polyethylene sheeting, 40 mils thick, ASTM D4068, joined with CPE solvent; or 3 lb./sq. ft. sheet lead.

Vent Flashings
Manufacturers: Semco, Oatey, or approved equal.

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.

PART 3 - EXECUTION

Installation
Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance 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.

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 in accordance to Wis. Dept. of Commerce 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.

Where backflow preventers requiring Dept. of Commerce registration are installed, provide initial registration, testing and report filing required by Dept. of Commerce. 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 hose bibbs securely fastened to wall where indicated. Provide water hammer arrestor in line to hose bibb.

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 safing 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.

Agency Training
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 78 23.

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Thermometers
- Thermometer Sockets
- Test Wells
- Test Plugs
- Pressure Gauges
- Strainers

PART 3 - EXECUTION
- Thermometers
- Thermometer Sockets
- Test Wells
- Test Plugs
- Pressure Gauges
- Strainers

Related Work
Section 22 11 00 - Facility Water Distribution
Section 22 13 00 - Facility Sanitary Sewerage
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.

Design Criteria
All piping specialties are to be rated for the highest pressures and temperatures in the respective system in accordance 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, or approved equal.

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, ^{o}F	30 - 180
Increment, ^{o}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, or approved equal.

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, or approved equal.

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Quality Assurance

Submittals
Operation and Maintenance Data
Design Criteria

PART 2 - PRODUCTS
Water System Valves
Ball Valves
Swing Check Valves
Spring Loaded Check Valves
Stop and Waste Valves
Balance Valves
Drain Valves
Buried Water Service Valves
Natural Gas Systems
Shut-off Valves
Gas Pressure Regulators
Specialty Valves and Valve Accessories
Gauge Valves
Safety Relief Valves

PART 3 - EXECUTION
General
Shut-off Valves
Balancing Valves
Drain Valves
Spring Loaded Check Valves
Swing Check Valves
Safety Relief Valves
Gas Pressure Regulators

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 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.

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, or approved equal.

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, or approved 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, or approved equal.

Stop and 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, or approved equal.

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, or approved equal.

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, or approved equal.

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, or approved equal.

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, or approved equal.

Exterior Below Grade Shut-Off Valves:
Plug 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.

Specialty Valves And Valve Accessories
Gauge Valves:
Use 1/4" ball valves. Needle valves and gauge cocks will not be accepted.

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).

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.

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 in accordance to codes. Use a larger size vent when required by the manufacturer's installation instructions.

END OF SECTION 22 05 23

Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

PART 1 - GENERAL

Scope
This section includes specifications for supports of all plumbing equipment and materials as well as piping system anchors. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Description
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS
- Manufacturers
- Structural Supports
- Pipe Hangers and Supports
- Beam Clamps
- Riser Clamps
- Concrete Inserts
- Continuous Concrete Insert Channels
- Anchors
- Equipment Stands
- Corrosive Atmosphere Coatings

PART 3 - EXECUTION

Installation
Hanger and Support Spacing
Riser Clamps
Concrete Inserts and Continuous Insert Channels
Anchors
Roof Mounted Piping Supports

Related Work
Section 03 30 00 - 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
MSS SP-69

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 01 33 00.

Design Criteria
Materials and application of pipe hangers and supports shall be in accordance to MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

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

Manufacturers
Anvil, B-Line, Pate, Piping Technology, Roof Products and 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.

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.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8

Beam Clamps
MSS SP-69 Types 19 and 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-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.

Concrete Inserts
Poured In Place:
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.

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 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, or approved equal.

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.

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.

Corrosive atmospheres include the following locations:
- Inspection Pits
- Inspection Tunnel
- Scale Pit
- Exterior Areas

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 in accordance 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:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
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"
Ductile Iron	All	10'-0"	20'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-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"

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.

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Description
- Definitions
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Materials
- Insulation and Jackets
- Accessories

PART 3 - EXECUTION
- Installation
- Piping, Valve and Fitting Insulation
- Equipment Insulation
- Construction Verification Items

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 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 and 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:

- Pipe Insulation
- Equipment Insulation

Install all insulation in accordance 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 DOT 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.

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.

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.

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 in accordance 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:

- Cold water (potable and non-potable)
- 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 polyeolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces.

Pipe Insulation Schedule:
Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	**Insulation Types**	**Insulation Thickness by Pipe Size**		
		1" and smaller	1-1/4" to 2"	2-1/2" to 4"
Hot Water Supply	Rigid Fiberglass	1"	1"	1.5"
Hot Water Circulating	Rigid Fiberglass	1”	1”	1.5”
Cold Water	Rigid Fiberglass	0.5”	0.5”	1”
Tempered Water	Rigid Fiberglass	0.5"	0.5"	1"
Non-Potable Cold Water	Rigid Fiberglass *	0.5”	0.5”	1"

* = Elastomeric and Phenolic types are acceptable

The following piping and fittings are not to be insulated:
- Chrome plated exposed supplies and stops (except where specifically noted).
- Water hammer arrestors.
- 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:

Equipment	**Insulation Type**	**Thickness**	**Remarks**
Pressure 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 10 13 - Facility Fuel Piping

PART 1 - GENERAL

Scope
This section contains specifications for fuel pipe and fuel pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications
- Natural Gas Service

PART 2 - PRODUCTS
- LP Gas
- Vents and Relief Valves
- Unions and Flanges

PART 3 - EXECUTION
- Preparation
- Erection
- Welded Pipe Joints
- Threaded Pipe Joints
- LP Gas
- Vents and Relief Valves
- Unions and Flanges
- Piping System Leak Tests
- Construction Verification Items
- Piping System Test Report

Related Work
Section 22 05 14 - Plumbing Specialties
Section 22 05 19 - Meters and Gages for Plumbing Piping
Section 22 05 23 - General-Duty Valves for Plumbing Piping
Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
Section 22 07 00 - Plumbing Insulation.

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
ANSI B31.9	Pipe Material Requirements

Quality Assurance

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

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.

Quality Assurance

Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance to the appropriate ASTM specification.

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.

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 in accordance 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 in accordance to the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

PART 2 - PRODUCTS

LP 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.

2-1/2" and Larger: ASTM A53, type E or S, standard weight black steel pipe with 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.

2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on 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.

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 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 in accordance 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.

LP 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. Teflon tape is acceptable for use on natural gas lines.

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.

Systemqqq	Pressure	Medium	Duration
LP gas	100 psig	Air	24 hr

All pressure tests are to be documented on a Division of State Facilities 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 22 10 13

Date Submitted: _____

Project Name: _____

Location: _____ **DOT Project No:** _____

Contractor: _____

□ **HVAC** □ **Refrigeration** □ **Controls**
□ **Power Plant** □ **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: _____

Start Test Time: _____ **Initial Pressure:** _____ **PSIG**

Stop Test Time: _____ **Final Pressure:** _____ **PSIG**

Tested By: _____ Witnessed By: _____

Title: _____ Title: _____

Signed: _____ Signed: _____

Date: _____ Date: _____

Comments: _____

_____

_____

Section 22 11 00 - Facility Water Distribution

PART 1 - GENERAL

Scope
This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS
- Domestic Water
- Dielectric Unions and Flanges
- Unions and Flanges

PART 3 - EXECUTION
- General
- Preparation
- Erection
- Copper Pipe Joints
- Domestic Water
- Underground Pipe Wrap
- Dielectric Unions and Flanges
- Unions and Flanges
- Piping System Leak Tests
- Construction Verification Items

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 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 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.

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.

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.

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.

PART 3 - EXECUTION

General
Install pipe and fittings in accordance to reference standards, manufacturer's 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.

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 in accordance 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 supervising engineer. All pressure tests are to be documented on **Division of State Facilities** forms to be provided to the contractor.

Test		Initial Test		Final Test	
System	Medium	Pressure	Duration	Pressure	Duration
*Below Ground	Domestic Water	Water	N/A	200 psig	2 hr
Above Ground	Domestic Water	Water	N/A	100 psig	8 hr
Above Ground	Non-pot. 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

Date Submitted: _____

Project Name: _____

Location: _____ **DOT 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: ___

Start 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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria

PART 2 - PRODUCTS
- Sanitary Waste and Vent

PART 3 - EXECUTION
- General
- Preparation
- Erection
- Solvent Welded Pipe Joints
- Mechanical Hubless Pipe Connections
- Mechanical Joint Pipe Connections
- Push-On Gasketed Pipe Connections
- Mechanical Grooved Pipe Connections
- Mechanically Formed Tee Fittings
- Sanitary Waste and Vent
- Piping System Leak Tests
- Construction Verification Items

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 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.

PART 2 - PRODUCTS

Sanitary Waste And Vent
Interior Above Ground:
Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 310, 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.

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.

All exposed piping throughout Inspection Areas shall be Cast Iron. PVC plastic pipe is not allowed.

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.

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.

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.

PART 3 - EXECUTION

General
Install pipe and fittings in accordance to reference standards, manufacturer’s 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.

Solvent Welded Pipe Joints
Install in accordance 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 **DOT** 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 in accordance to the coupling manufacturer's specifications or field grooved pipe in accordance to the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance 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.

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 in accordance to COMM 82.30(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 State Facilities forms to be provided to the contractor.

	Test	Initial Test		Final Test	
System	Medium	Pressure	Dur.	Pressure	Dur.
Sanitary Waste and Vent	Water	N/A		10' water	2 hr
Pressurized Sanitary Waste and Vent	Water	N/A		100 psig	2 hr
Acid Waste and Vent	Water	N/A		10' water	2 hr

Construction Verification Items
Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 or 01 91 02 in accordance to the procedures defined for construction verification checklists.

END OF SECTION 22 13 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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Documents
- Reference
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Water Heaters
- Water Softeners
- Pumps
- Sumps
- Controls

PART 3 - EXECUTION
- Installation
- Construction Verification Items
- Functional Performance Testing
- Agency Training

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 General Conditions of the Contract.

Plumbing products requiring approval by the State of Wisconsin Dept. of Commerce 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.

PART 2 - PRODUCTS

High Efficiency Commercial Gas Fired Water Heater
Manufacturers: A.O. Smith, Bradford White, Bock, Lochinvar, State, or approved equal.

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^{o}-180^{o}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.

Indirect Water Heater
Manufacturers: A.O. Smith, Bock, Cemline, Lochinvar, Super-Stor, or approved equal.

80 gallon vertical 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. With a 7-year manufacturers warranty.

Enamel lined coil heat exchanger with 1” supply and return connection to geothermal system. 1-1/2” connections to domestic water system.

Based on Super-Stor Contender SSC-80.

Water Softeners
Manufacturers: Amtrol, Capital, Custom-Care, Hellenbrand, Water Right, or approved equal.

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 consisting of the following:

Electronic Meter and 480 Microprocessor with LED Display for Delayed 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^{o}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.

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 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)						
Diameter	24	30	36	42	48	60	72
Max. 10' Depth	3/16	1/4	1/4	1/4	5/16	5/16	3/8

Provide anti-flotation flange and concrete ballast for high groundwater conditions.

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.

Sump Pumps
Manufacturer: Aurora/Hydromatic, Gould, Little Giant, Myers, Paco, Stancor, Sta-Rite, Weil, Zoeller, or approved equal.

Simplex explosion proof system is required for Inspection Area (SP-2).

Duplex system is required for Scale Pit (SP-1).

Type: Submersible pumps constructed of epoxy coated cast iron shell, cast iron volute, two vane enclosed semi-open, 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:
- Single On/Off float switch, UL listed.
- Double (one On, one Off) float switch, UL listed.
- Triple (1st pump On, 2nd pump on, both pumps Off) float switch, UL listed.
- Four (1st pump On, 2nd pump on, both pumps Off, high level alarm) float switches, UL listed.
- NEMA 1 indoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
- NEMA 4 indoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
- Combination magnetic starter with fused disconnect switch, HOA switch, run light, resettable overload heaters, NEMA 1 and NEMA 4, UL listed.
- 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 and NEMA 4.

- 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 in the Scale Pit and NEMA 4 in the Inspection Areas

Accessories:
- 20’ power cord.
- NEMA 4 junction box for Inspection Areas.
- Discharge check valve, fullport ball valve and union for each pump.
- Dual mechanical seals, seal leak detector probe and warning light in control panel.
- 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.

In-Line System Lubricated Centrifugal Pumps
Manufacturer: Bell and Gossett, Grundfos, Taco, or approved equal.

Type: Horizontal single stage close coupled system lubricated in-line pumps, 125 psig maximum working pressure at operating temperature of 225^{O}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.

Expansion Tanks
Manufacturer: Amtrol, Bell and Gossett, Flexcon, Wessels, or approved equal.

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 in accordance 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.

Construction Verification Items

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 or 01 91 02 in accordance to the procedures defined for construction verification checklists.

Agency Training
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 78 23.

END OF SECTION 22 30 00

Section 22 42 00 - Commercial Plumbing Fixtures

PART 1 - GENERAL

Scope
This section includes specifications for plumbing fixtures, faucets and trim.

PART 1 - GENERAL
- Scope
- Related Work
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria
- Energy Efficiency Requirements

PART 2 - PRODUCTS
- Plumbing Fixtures

PART 3 - EXECUTION
- Installation
- Construction Verification Items

Related Work
Section 22 11 00 - Facility Water Distribution
Section 22 13 00 - Facility Sanitary Sewerage
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 General Conditions of the Contract, Equals and Substitutions.

Plumbing products requiring approval by the State of Wisconsin Dept. of Commerce 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.

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.

Energy Efficiency Requirements
Plumbing fixtures must meet the following maximum water usage requirements which are based upon Federal Energy Management Program (FEMP) performance requirements.

- Lavatory Faucets, flow of 2 gpm or less and .25 gallon per cycle or less (based on inlet pressure of 60 p.s.i.)
- Showerheads, flow of 2.2 gpm or less (based on inlet pressure of 80 p.s.i.)
- Urinal Flush Valves, 1.0 gallon per flush or less.
- 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.

- Water Closets - American Standard, Kohler, Crane Plumbing/Fiat Products, Eljer.
- Water Closet Seats - Bemis, Beneke, Centoco, Olsonite Sperzel.
- Urinals – American Standard, Kohler, Crane Plumbing/Fiat Products, Eljer.
- Lavatories – American Standard, Kohler, Crane Plumbing/Fiat Products, Eljer.
- Faucets - Chicago Faucet, Kohler, Speakman, Symmons, T&S Brass.
- Drains - Chicago Faucet, Engineered Brass Co., Kohler, McGuire.

- Stops and Supplies - Chicago Faucet Co., T&S Brass, McGuire. (Heavy Duty Type Only)
- Flush Valves - Coyne & Delany, Sloan Royal, Zurn AV.
- Traps - Kohler, McGuire, Dearborn, Engineered Brass Co. (17 gauge Min.)
- Carriers and Supports - Josam, Smith, Wade, Watts Drainage, Zurn.
- Sinks - American Standard, Elkay, Just, Kohler.
- Service Sinks - American Standard, Crane, Kohler.
- Mop Basins - Fiat, Mustee, Stern-Williams.
- Electric Water Coolers - Elkay, Halsey Taylor, Haws, Filtrine, Oasis, Sunroc.
- Emergency Eyewash Fountains and Showers - Bradley, Chicago Faucet Co., Guardian, Haws, Speakman.

Note:
The fixtures listed below are based as a design guideline only and is only listed as product that was based for the design, a similar product from another manufacture is acceptable if equal to the listed items.

Water Closets:
WC-1 - 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 Optima model 111ES-S.
- Transformer: Sloan model EL-154
- Seat: Bemis 1655-SS/C white solid plastic open front.

Urinals:
U-1 - Wall mount white vitreous china waterless urinal, 2" outlet, removable strainer, cartridge-free trapway, splash free design. Rough-in ¾” CW piping to behind urinal. Install urinal to cover piping rough-in and install per ADA.

- Fixture: Kohler Steward K-4918.
- Flush Valve: N/A.
- Carrier: Smith commercial grade adjusted for ADA height.

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 barrier free white vitreous china lavatory drilled for concealed arm carrier with electronic single-hole faucet and left hand soap dispenser hole drillings, 0.5 GPM. Provide ADA insulation over all existing piping and stops. Transformer shall be mounted above ceiling behind an 18” access panel.

- Fixture: Kohler Kingston K-2007-L.
- Faucet: Chicago Faucet No 116.101.21.1.
- Transformer Chicago Faucet model 240.631.00.1 (max 8 faucet operation)
- Mixing Valve: Chicago Faucet model 119 Thermostatic Mixing Valve.
- 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 and Stops: Chicago Faucet No. 1006.
- Carrier: Smith floor mounted concealed arm adjusted for ADA height.

L-2 – Sink is integral with counter provided by G.C., Provide faucet with 4" centers, wrist blade handles.

- Fixture: Integral with counter – By G.C.
- Faucet: Chicago Faucet No. 802-317-244CP.
- 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 and Stops: Chicago Faucet No. 1006CP.

Sinks:
S-1 - Counter mounted 18ga type 304 stainless steel double compartment sink, fully under coated with 3 faucet openings, stainless steel basket strainers and Chicago faucet with wristblade handles and swing spout. Provide ¾ hp garbage disposal.

- Fixture: Elkay LR-3321.
- Faucet: Chicago Faucet No. 1100-L9-317CP.
- Drain: Elkay LK-35
- Trap: 1-1/2"x1-1/2" 17 ga. cast brass trap and tubular wall bend, With C.O. plug.
- Supplies and Stops: Chicago Faucet No. 993-CP w/ 1/2" riser, length as necessary.
- Disposer: Insinkerator Badger 5XP, ¾ HP, 120V

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 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)

Electric Water Coolers:
EWC-1 - Dual level, wall mounted, barrier free and standard height, stainless steel finish water cooler with front pushbar operators. Single recessed steel mounting box with refrigeration system and stainless steel removable front grille for access. Rated for 8.6 GPH at 80-degree inlet water at 90-degree ambient temperature and 50-degree outlet water. 120/60/1. Mount so upper unit spout is at 40" above floor.

- Fixture: Elkay VRCTL8SC
- Traps: 1 1/4"x1 1/4" 17 ga. cast brass, with C.O. plug.
- Stops: 1/2" ball valve with ½" riser (concealed).

Emergency Eyewash Fountains And Showers:
EEW-1 - Floor mounted emergency eyewash and shower with Spin Tec shower head and plastic 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. With mixing valve and wall cabinet assembly for 3-64 GPM, primary valve with built in cold water bypass capable of 20 GPM @ 30 PSI upon failure of hot water supply.

- Fixture: Bradley S19-310.
- Mixing Valve: Leonard TM-850-STSTL-EXP

PART 3 - EXECUTION

Installation

Install plumbing fixtures in accordance 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

End Of Division 22 – Plumbing

59. SWEF Building, Heating and Ventilation, SPV.0105.16.

A Description
This item consists of the HVAC work for the SWEF building. The work shall be in accordance to the applicable plans and the following specifications.

B (Vacant)

C (Vacant)

D Measurement
The department will measure SWEF Building, Heating and Ventilating as a single lump sum unit of work, 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.0105.16	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 – Heating, Ventilation and Air Conditioning

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Protection of Finished Surfaces
- Sleeves and Openings
- Sealing and Firestopping
- Submittals
- Off Site Storage
- Request and Certification for Payment
- Certificates and Inspections
- Operating and Maintenance Data
- Record Drawings

PART 2 - PRODUCTS
- Access Panels and Doors
- Identification
- Sealing and Firestopping

PART 3 - EXECUTION

Excavation and Backfill
Concrete Work
Cutting and Patching
Building Access
Equipment Access
Coordination
Identification
Lubrication
Sleeves
Sealing and Firestopping
Agency Training

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
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 and 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.

Submit sufficient quantities of shop drawings to allow the following distribution:

- Operating and Maintenance Manuals 2 copies
- A/E 1 copy

Not more than two weeks after award of contract but before any shop drawings are submittal, the contractor shall submit the following piping system data sheet for each piping service on the project. The approved piping system data sheet(s) will be made available to the engineer for their use on this project.

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. Certificates of inspection by regulatory agencies
3. Valve schedules
4. Lubrication instructions, including list/frequency of lubrication

Off Site Storage

Prior approval by OWNER and the A/E will be needed. The contractor shall submit Storage Agreement Form AD-BDC-74 to OWNER for consideration of offsite materials storage.

Generally, ductwork, metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for offsite storage. For material that can be stored off site, no material will be accepted for offsite storage unless shop drawings for that material have been approved.

Request And Certification For Payment

Within 10 days after Notice to Proceed, the successful bidder will submit to the engineer 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 OWNER, 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 in accordance to Wis Adm Code Section ILHR 50.12. Deliver originals of these certificates to the Division 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 _8_ 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.

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 judgment 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 in accordance 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.

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 in accordance to the manufacturer's instructions until the work is accepted by 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

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

Wet locations include:

- Pits

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:

- Pits

Sealing And Firestopping

Fire And/Or Smoke Rated Penetrations:

Install approved product in accordance 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, in accordance 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 sections includes requirements for single and three phase motors that are used with equipment specified in other sections. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operating and Maintenance Data
- Electrical Coordination
- Product Criteria

PART 2 - PRODUCTS
- Three Phase, Single Speed Motors
- Single Phase, Single Speed Motors
- Two Speed Motors
- Motors Used for Reduced Voltage Starting

PART 3 - EXECUTION
- Installation

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.

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 in accordance to utility requirements and compatible with starters as specified.

PART 2 - PRODUCTS

Three Phase, Single Speed Motors
Use NEMA rated 230 volt, 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 in accordance to NEMA MG 1.

FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED

MOTOR	-----Open Drip-Proof Motors------ -------Nominal Motor Speed-------		
HP	1200 rpm	1800 rpm	3600 rpm
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

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.

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 in accordance 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 in accordance 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 in accordance 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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Thermometers
- Thermometer Sockets
- Test Wells
- P/T (Pressure/Temperature) Test Plugs
- Pressure Gauges
- Strainers
- Expansion Tanks
- Air Separators
- Air Vents
- Vacuum Breakers
- Differential Pressure Gauge

PART 3 - EXECUTION

Thermometers
Thermometer Sockets
Test Wells
P/T (Pressure/Temperature) Test Plugs
Pressure Gauges
Strainers
Expansion Tanks
Air Separators
Air Vents
Vacuum Breakers
Differential Pressure Gauge

Related Work
Section 23 21 13 - Hydronic 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

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.

Design Criteria
All piping specialties are to be rated for the highest pressures and temperatures in the respective system in accordance 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, or approved equal.

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	Scale Range, °F	Min. Increment, °F
Hot Water	30 - 240	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 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.

Pressure Gauges
Manufacturers: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler, or approved equal.

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.

Pressure Snubbers:
Bronze construction, suitable for system working pressure, 1/4" size.

Coil Syphons:
Bronze or steel 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, or approved equal.

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.

Expansion Tanks
Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, Taco, Wessels, or approved equal.

Standard Type:
Steel construction, tested and stamped in accordance to Section 8D of the ANSI/ASME Code and furnished with the National Board Form U-1, red line gauge glass with guard and cocks, drain valve with hose adapter, air charging device, system connection, rated for not less than 125 psi working pressure, prime coated, mounting saddles for horizontal installation or base for vertical installation, size/capacity as indicated on the drawings.

Bladder Type:
Steel construction, tested and stamped in accordance 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 diaphragm 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, or approved equal.

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 he 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.

Differential Pressure Gauge
Barton 247A, Midwest 809, or approved equal.

Bellows type differential pressure meter kit that includes a six inch diameter gauge with a 270° arc having an accuracy of ±1% of full scale or better and suitable for the differential pressures of the flow meters supplied for this project, over range protection on the meter, color coded hoses not less than ten feet in length with brass connectors suitable for connection to the low and high pressure connections on the balance valves, inline strainers, instrument valving so meter can be vented and drained, pressure and temperature rating at least equal to that of the valves. Provide meter and all accessories in a durable case with carrying handle.

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.

Coil Syphons:
Install in gauge piping for all gauges used on steam 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.

Expansion Tank
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.

Standard Tanks:
Charge tank with the proper amount of air and water during the initial fill after the system has been flushed and cleaned.

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.

Differential Pressure Gauge
Handle as a loose and detachable part as outlined in the General Requirements.

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Manufacturers
- Bypass Valves
- Water System Valves
- Gate Valves
- Ball Valves
- Butterfly Valves
- Globe Valves
- Swing Check Valves
- Spring Loaded Check Valves
- Balance Valves
- Drain Valves
- Combination Shut-off, Check, and Balancing Valves
- Water Pressure Reducing Valves
- Water Relief Valves
- Natural Gas Systems
- Shut-off Valves
- Gas Pressure Regulators

PART 3 - EXECUTION
- General
- Shut-off Valves
- Balancing Valves
- Calibrated Balancing Valves
- Drain Valves
- Safety Relief Valves
- Spring Loaded Check Valves
- Swing Check Valves
- Combination Shut-off, Check, and Balancing Valves
- Automatic Non-return Stop Valves
- Pressure Reducing Valves
- Gas Pressure Regulators

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.

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 engineer.

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.

Bypass Valves
A bypass gate valve is required on main steam shutoff valves 4 inch and larger on steam pressures greater than 15 psig for supervised warmup.

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 stainless steel. Pressure rated to 150 psig. Valve assembly to be bi-directionally bubble tight to 150 psig with no downstream flange/pipe attached. 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 BGS II, Keystone Fig. 222, Nibco LD2000 (2-1/2”-12”)/LD1000 (14” and above), 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.

Include one bellows type differential pressure meter kit that includes a six inch diameter gauge with 270° arc readout and having an accuracy of ±1% of full scale or better and suitable for the differential pressures of the valves supplied for this project, over-range protection, color coded hoses not less than ten feet in length with brass connectors suitable for connection to the low and high pressure connections on the balance valves, instrument valving so meter can be vented and drained, pressure and temperature rating at least equal to that of the valves. Provide meter and all accessories in a durable case with carrying handle.

Barton 247A, Midwest 809.

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.

2-1/2" through 4": Cast iron body, flanged ends, bronze bearings, electroless nickel plated cast iron plug with Hycar resilient plug seal, Buna-N stem seal packing, lever actuator, 175 psi W.O.G., 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.

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.

Vent steam safety valves to a location outside of building, in the most direct manner possible. Install drip pan elbow as detailed at first vertical rise of the vent pipe. Keep pipe between safety valve and drip pan elbow as short and straight as possible.

Support piping and drip pan elbow independently to prevent stress at connections to safety valves. Install vent pipe so that its weight does not rest on the drip pan elbow. Extend drain line from drip pan elbow and relief valve to nearest drain.

Pipe discharge from water system relief valves to nearest drain.

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 in accordance 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 in accordance 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 sections includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Description
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS
- Pipe Hanger and Support Manufacturers
- Structural Supports
- Pipe Hangers and Supports
- Beam Clamps
- Concrete Inserts
- Continuous Concrete Insert Channels
- Anchors
- Equipment Curbs
- Equipment Stands

PART 3 - EXECUTION
- Installation
- Hanger and Support Spacing
- Vertical Riser Clamps
- Concrete Inserts and Continuous Insert Channels
- Anchors
- Equipment Curbs
- Equipment Stands

Related Work
Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
Section 23 07 00 - HVAC Insulation

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

Reference Standards
MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.
MSS SP-59 Pipe Hangers and Supports - Selection and Application.

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 in accordance to MSS Standard Practice SP-58 and SP-69 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
B-Line, Fee and Mason, Grinnell, Kindorf, Michigan Hanger, Unistrut, or approved equal. Grinnell figure numbers are listed below; equivalent material by other manufacturers is acceptable.

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
Until this section gets revised, the consultant will have to insert roller hangers for use on hot piping (LPS, HPS and any other service with a fluid temperature over 220°F) and insulation protection shields for use between a hanger and insulation.

Hangers For Steel Pipe Sizes 1/2” Through 2”:
Carbon steel, adjustable, clevis, black finish. Grinnell figure 65 or 260.

Hangers For Steel Pipe Sizes 2-1/2” And Over:
Carbon steel, adjustable, clevis, black finish; or adjustable steel yoke, cast iron roll, double hanger. Grinnell figure 260. Use Grinnell figure 181 for steam lines.

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, Grinnell 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, Grinnell type PS200 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, Grinnell PS 1400 series.

Vertical Riser Support:
Carbon steel riser clamp, copper plated when used with copper pipe. Grinnell figure 261 for steel pipe, figure CT121 for copper pipe.

Floor Support For Pipe Sizes Through 4":
Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

Floor Support For Pipe Sizes 5" And Over:
Adjustable cast iron roll and stand, steel screws, 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 Grinnell 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.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
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.

Beam Clamps
MSS SP-69 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. Grinnell figure 86.

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 but limited in application to pipe sizes 8 inch and less without prior approval. Grinnell figure 228.

Concrete Inserts
MSS SP-69 Type 18 wedge type or universal concrete inserts

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.

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.

Use the following when the inserts are placed after the concrete is poured.

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, duct, and conduit in the area.

Anchors
Use welding steel shapes, plates, and bars to secure piping to the structure.

Equipment CURBS
Manufacturers: Custom Curb, Pate, Roof Products and Systems, ThyCurb, Vent Products.

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. Do not use built-in metal base flashings or cants. Use

18 inch high equipment curbs where the curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

Equipment Stands
Use contractor fabricated stand consisting of structural steel members supported by pipe supports; protect the pipe through roof as specified below under Pipe Penetration Through Roof. All steel exposed to the weather to be galvanized or stainless.

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.

Coordinate hanger and support installation to properly group piping of all trades.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

Perform all welding in accordance to standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

Hanger And Support Spacing
Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain the slope specified in the piping section of this specification.

Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"
Steel	8" through 12"	14'-0"
Steel	14" and over	20'-0"
Thermoplastic	All sizes	6'-0"
Copper	1/2" through 1-1/4"	5'-0"
Copper	1-1/2" and larger	8'-0"

Vertical 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.

Piping 5” and above, of lengths exceeding 30 feet, shall be additionally supported on base elbows secured to the building structure, with flexible supporting hangers provided at top of riser to allow for pipe expansion.

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 8'-0" maximum centers and 2'-0" from corners. Furnish inserts to the General Contractor for placement in concrete formwork. Use insets 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.

Equipment Curbs
Secure bottom of support flat on roof deck. Secure equipment to curb in accordance to equipment manufacturer's instructions. Flashing and counterflashing by the General Contractor.

Equipment Stands
Height of pipe support to be selected from the following table, based on the maximum width of the equipment being supported:

Length of Support Rail (inches)	Min. Curb Height Above Deck
to 24	14 inches
25 - 36	18
37 - 48	24
49 - 60	30
61 and over	48

Weld vertical pipe supports to horizontal support members. Apply two coats of zinc rich paint to cut edges and welded areas of galvanized steel elements.
END OF SECTION 23 05 29

Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

PART 1 - GENERAL

Scope
This section includes specifications for vibration isolation material for equipment, piping systems, and duct systems. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Quality Assurance
- Design Criteria
- Shop Drawings

PART 2 - PRODUCTS
- Materials
- Vibration Isolation Manufacturers
- Type 1: Neoprene Pad
- Type 2: Neoprene Pad
- Type 3: Unhoused Spring with Neoprene
- Type 5: Spring Hanger with Neoprene
- Type 6: Precompressed Spring with Neoprene
- Type 7: Spring Hanger with Deflection Indicator
- Type 8: Spring Hanger with Neoprene
- Type AG: Vertical Pipe Anchor and Guide
- Flexible Piping Connections
- Performance
- Blower Minimum Deflection Guide

PART 3 - EXECUTION

Installation

Related Work

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 21 23 - Hydronic Pumps
Section 23 34 00 - HVAC Fans
Section 23 33 00 - Air Duct Accessories

Reference

Applicable provisions of Division 1 govern work under this section.

Quality Assurance

Refer to division 1, General Conditions, Equals and Substitutions.

Design Criteria

Isolate all motor driven mechanical equipment from the building structure and from the systems which they serve to prevent equipment vibrations from being transmitted to the structure. Consider equipment weight distribution to provide uniform isolator deflections.

For equipment with variable speed capability, select vibration isolation devices based on the lowest speed.

Provide flexible piping connections for all piping to rotating or reciprocating equipment mounted on vibration isolators except do not use flexible piping connectors on any type of gas piping or with inline pumps. Piping connected to a coil which is in an assembly mounted on vibration isolators is to have flexible piping connections and piping vibration hangers as specified below. Piping connected to a coil which is in an assembly where the fan is separately isolated by means of vibration isolators and duct flexible connections does not require flexible piping connectors or piping vibration hangers.

Credit will be given for the inherent flexibility and vibration absorption characteristics of mechanical grooved pipe connections providing that supporting calculations are submitted for approval.

Coordinate the selection of devices with the isolator and equipment manufacturers.

Shop Drawings

Refer to division 1, General Conditions, Submittals.

Include isolator type, materials of construction, isolator free and operating heights, and isolation efficiency based on the lowest operating speed of the equipment supported.

PART 2 - PRODUCTS

Materials
Use materials that will retain their isolation characteristics for the life of the equipment served. Use industrial grade neoprene for elastomeric materials.

Treat all isolators to resist corrosion. For isolation devices exposed to the weather or used in high humidity areas, hot dip galvanize steel parts, apply a neoprene coating on all steel parts, or use stainless steel parts; include limit stops to resist wind.

Provide pairs of neoprene side snubbers or restraining springs where side torque or thrust may develop.

Use isolators with a ratio of lateral to vertical stiffness not less than 1.0 or greater than 2.0.

Vibration Isolator Manufacturers
Mason Industries, Amber/Booth Co., Vibration Mounting and Controls, Peabody Noise Control, or approved equal.

Type 1: Neoprene Pad
Neoprene waffle pad, 40 durometer with 16 gauge shims between layers.

Type 2: Neoprene Pad
Double deflection neoprene mount having a minimum static deflection of 0.35 inches. Cover all metal surfaces with neoprene to resist corrosion. Include friction pads on both top and bottom surfaces so mounts need not be bolted to the floor but include bolt holes for those areas where bolting is required. For equipment such as small vent sets and close coupled pumps, include steel rails for use between the isolator and the equipment to accommodate equipment overhang.

Type 3: Unhoused Spring With Neoprene
Combination freestanding, unhoused spring and neoprene with rib molded antifriction base. Include leveling bolts for securing to the equipment. Springs to be laterally stable under load and selected so they have an additional travel to solid equal to 50% of the rated deflection. Use height saving brackets when appropriate to the application.

Type 5: Spring Hanger With Neoprene
Vibration hanger with a steel spring and 0.3" deflection neoprene element in series. Use neoprene element molded with a rod isolation bushing that passes through the hanger box. Select spring diameters and size hanger box lower holes large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Select springs so they have a minimum additional travel to solid equal to 50% of the rated deflection.

Type 6: Precompressed Spring Hanger With Neoprene
Vibration hanger similar to Type 5 but precompressed to the rated deflection to keep the piping or equipment at a fixed elevation during installation. Design hanger with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load.

Type 7: Spring Hanger With Deflection Indicator
Steel spring hanger in a steel housing which include a deflection indicator scale, designed to accommodate vertical pipe expansion. Preset hanger at the factory for the required load. Design hanger for 130% of rated deflection but use no more than 100% of rated deflection when selecting the hanger.

TYPE 8: SPRING HANGER WITH NEOPRENE
Steel spring hanger located in a neoprene cup manufactured with a grommet to prevent short circuiting of the hanger rod. Neoprene cup to contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Design spring diameter and size hanger box lower hole sufficiently large to permit the hanger rod to swing through a 30° arc before contacting the hole perimeter and short circuiting the spring. Select spring so it has a minimum additional travel to solid equal to 50% of the rated deflection. Provide hanger with an eye bolt on the spring end and provision to attach the housing to the flat iron duct straps.

Type Ag: Vertical Pipe Anchor And Guide
All directional acoustical pipe anchor and guide consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum half inch thickness of heavy duty neoprene and duck or neoprene isolation material. Provide vertical restraints of similar material to prevent vertical travel in either direction. Design isolation materials for a maximum allowable load of 500 psi, balanced for equal resistance in any direction.

Flexible Piping Connections
Suitable for pressure, temperature, and fluid involved; minimum pressure rating for any system is 125 psig at the design temperature of the fluid. Use 12 inch minimum line length of flexible hose or length required to absorb 3/4" lateral movement, whichever is greater.

Manufacturers:
Flexonics, Mason, Mercer Rubber, Metraflex, or approved equal.

Water And/Or Pumped Condensate:
Multiple plies of nylon tire cord fabric reinforced with an EPDM cover and liner. Do not use steel wire or rings as pressure reinforcement. Use threaded or soldered connections for sizes 2" and smaller and floating steel or ductile iron flanges for sizes 2-1/2" and larger; design the steel flange end so the steel flange is recessed to lock a steel wire bead ring in the raised face of the EPDM flange. Construct straight-through connections with twin spheres. Use control rods when recommended by the manufacturer.

Refrigerant:
Seamless bronze corrugated flexible hose with bronze wire braided cover and solder type copper tube ends with the entire assembly fabricated specifically for refrigerant duty.

Performance
Select vibration isolation devices as indicated below or to provide not less than 95% isolation efficiency, whichever is greater.

	---------- Floor Span or Column Spacing----------							
	--On Grade--		---20 Feet---		---30 Feet---		---40 Feet---	
TYPE OF EQUIPMENT	Min. Static Iso. Type	Defl. In.	Min. Static Iso. Type	Defl. In.	Min. Static Iso. Type	Defl. In.	Min. Static Iso. Type	Defl. In.
PUMPS:								
Base Mounted Close Coupled Through 5 hp	Bolt to pad		3-IB	0.75	3-IB	0.75	3-IB	0.75
AIR-COOLED CONDENSING UNITS:	Bolt to pad		3	0.75	4	1.50	4	2.50
PACKAGED AIR HANDLING UNITS:								
Suspended Through 5 hp	-	-	5	1.00	5	1.00	5	1.00
Floor mounted Through 5 hp	3	0.35	3	0.75	3	0.75	3	0.75

CABINET FANS AND FAN SECTIONS OF AIR HANDLING UNITS:
Suspended Type 5-T supports with deflection from blower minimum deflection guide. Type T needed only when air thrust exceeds 10% of equipment weight.

DUCTWORK IN MECHANICAL EQUIPMENT ROOMS: Use type 8 hanger with .75" minimum deflection for all ducts with a cross sectional area greater than 2.0 square feet and, where either the air velocity is great than 3500 fpm or, the pressure class is 4" water column or higher.

BLOWER MINIMUM DEFLECTION GUIDE

	Required Deflection (Inches)			
Fan Speed (RPM)	On Grade	20' Floor Span	30' Floor Span	40' Floor Span
175-224	0.35	3.50	4.50	4.50
225-299	0.35	3.50	3.50	3.50
300-374	0.35	2.50	2.50	3.50
375-499	0.35	1.50	2.50	3.50
500 and over	0.35	0.75	1.50	2.50

PART 3 - EXECUTION

Installation
Install vibration isolation devices for motor driven equipment in accordance to the manufacturer's installation instructions.

Set steel and inertia bases for one inch clearance between the concrete floor or housekeeping pad and the base.

Do not allow installation practices to short circuit any isolation device.

Install flexible piping connections on the equipment side of shut-off valves.

Packaged Air Handling Units And Centrifugal Fans
Attach horizontal thrust restraints at the centerline of thrust and symmetrically on either side of the unit. Thrust restraints are not required when the fan section in not isolated from the remainder of the air handling unit by means of duct flexible connections.
END OF SECTION 23 05 48

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards

Description
Pre-Installation Meeting and Scheduling
Pre-Balance Conference
Submittals

PART 2 - PRODUCTS
Instrumentation

PART 3 - EXECUTION
Preliminary Procedures
Existing Equipment
Performing Testing, Adjusting and Balancing
Deficiencies

Related Work
Section 23 05 00 Common Work Results for HVAC
Section 23 07 00 HVAC Insulation

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.

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 in accordance to standards published by AABC or NEBB.

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 in accordance 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 in the specific area of work performed. Maintain certification for the entire duration of the project. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact DOT immediately.

Technicians on this project must have satisfactorily completed work on a minimum of three projects of at least 50% in size, and of similar complexity.

Submit Qualifications of firm and project staff to the engineer upon requested.

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, Owner and the mechanical system and temperature control system installing contractors. Provide AE and Commissioning Provider (CxP) 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 or AABC Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance 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: Architect/Engineer

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 or AABC 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 in accordance to the requirements of NEBB or AABC 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 DOT upon request. Calibration and maintenance of all instruments to be in accordance to the requirements of NEBB or AABC Standards

PART 3 - EXECUTION

Daily Reports

Submit to engineer daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

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 engineer 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, in accordance 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 (in accordance 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 date 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.

Coordinate Fume Hood Monitor calibration with the Fume Hood Manufacturer.

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 DOT's 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 25 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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Description
- Definitions
- Shop Drawings
- Operation and Maintenance Data
- Environmental Requirements

PART 2 - PRODUCTS
- Materials
- Insulation Types
- Jackets
- Insulation Inserts and Pipe Shields
- Expansion Joint and Valve Insulation Blankets
- Accessories

PART 3 - EXECUTION
- Examination
- Installation
- Protective Jacket Installation
- Piping, Valve and Fitting Insulation
- Piping Protective Jackets
- Pipe Insulation Schedule
- Duct Insulation
- Ductwork Protective Coverings
- Duct Insulation Schedule
- Equipment Insulation
- Equipment Insulation Schedule
- Construction Verification Items

Related Work
Section 23 05 00 - Common Work Results for HVAC
Section 23 21 13 - 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 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 C355	Test Methods for Test for Water Vapor Transmission of Thick Materials
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	Unfaced Preformed Rigid Cellular Polyisocyanurate 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 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 D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics
ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
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 and 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 years, the contractor shall be able to document the successful completion of a minimum of three projects of at least 50% of the size and similar scope of the work specified in this section.

Fluid-applied ductwork insulation is a roofing product that shall be applied only by qualified contractors. Contractor shall be recognized by the manufacturer of the Polyurea 2-part liquid membrane system as an “approved” or “authorized” applicator. Only manufacturer recognized, qualified and authorized contractor’s who’s labor and material are fully covered, without exception, by the manufacturer’s warranty, as required by this section, will be allowed to perform the work. Manufacturer must submit letterhead document verifying the contractor as an authorized applicator of their product and able to receive the specified warranty.

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 in accordance 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 engineer.

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.

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 in accordance 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.

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 permeability of 0.0 perm inch, maximum water absorption of .2% by volume, rated for service range of -450 degrees F to 900 degrees F.

Fire-Stop Insulation:
Noncombustible, non-asbestos, non-ceramic fiber, high temperature blanket or board fireproofing insulation, constructed of calcium silicate or calcium/magnesium/silica amorphous wool with 3-hour ASTM E814 “F” and “T” fire ratings, UL or equivalent third party listed, labeled and specifically evaluated for such purpose in accordance to ASTM E2336. Foil-scrim-polyethylene fiberglass reinforced factory applied jacket.

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 in accordance to ASTM D1000 and flame spread/smoke developed rating of 10/20 when tested in accordance 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/pre-manufactured 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.

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 550ºF. 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 2 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 in accordance 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.

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

Pipe Insulation Schedule:
Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	Insulation	Jacket	Insulation Thickness by Pipe Size				
			≤ 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.

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"
20°F to -20°F	Ext Poly/Polyiso	VRJ or SAJ	1.5"	2"	2"	2"	2.5"
-20°F to -60°F	Ext Poly/Polyiso	VRJ or SAJ	2"	2"	2.5"	2.5"	3"

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 45ºF) 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 ¼" per foot to eliminate ponding and create positive drainage off of insulation. Refer to fluid-applied ductwork insulation section below for slope requirements.

Breeching:
Fasten insulation over weld pins and secure with washers. Space fasteners not less than 3" from edge or corner and 12" on center longitudinally and 9" on center in the transverse direction. 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.

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"
Exhaust and relief ducts downstream of motorized backdraft dampers	Rigid Fiberglass	FSJ	2”
All ducts exposed to weather	Ext. Polystyrene or Fluid-Applied**	SAJ	3”
Exhaust ducts downstream of heat recovery units and dessicant dryers	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.

** No jacket is required for Fluid-Applied ductwork insulation. The two part Fluid-Applied system serves as insulation and protective jacket.

Equipment Insulation
General:
Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

Protective Jackets:
Provide a protective metal jacket (PMJ) for the following: Generator exhaust pipe (that is not concealed in a shaft) and muffler.

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.

Removable Covers:
Provide insulated easily removable galvanized steel metal boxes for routine service access on the following equipment:

Provide insulated easily removable elastomeric insulation sections for the following equipment:
END OF SECTION 23 07 00

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS
- Heating Hot Water
- Makeup Water
- Chemical Treatment
- Vents and Relief Valves
- Unions and Flanges
- Gaskets
- Unions and Flanges

PART 3 - EXECUTION
- Preparation
- Erection
- Welded Pipe Joints
- Threaded Pipe Joints
- Mechanical Grooved Pipe Connections
- Copper Pipe Joints
- Water Systems
- Makeup Water
- Chemical Treatment
- Vents and Relief Valves
- Unions and Flanges

Gaskets
Piping System Leak Tests
Hydronic Piping System Flushing

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 A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
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.

Quality Assurance
Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance to the appropriate ASTM specification.

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 in accordance 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.

PART 2 - PRODUCTS

Heating Hot Water
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 to1/2 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.

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 ANSI B16.18 cast copper alloy unions on copper 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.

2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face

flanges ANSI B16.5 for mating with other raised face flanges on 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.

Gaskets
Water and Glycol Systems: Branded, compressed, non-asbestos sheet gaskets. Klingersil C4401, Garlock 3000, JM Clipper 978 or approved equal.

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 lose 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 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 in accordance to ASME Codes, ANSI B31, and State Codes where applicable.

All pipe welding shall be completed by Qualified Welders in accordance to the contractor's Procedure Specifications.

Contractor will ensure that these steps are followed where pipe sections will be joined by welding:

- Cleaning – Welding surfaces will be clean and free of defects.
- Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16".
- Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.
- Girth Butt Welds:
- Girth butt welds shall be complete penetration welds.
- Concavity will not exceed 1/32"
- Under cuts will not exceed 1/32"

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.

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 DOT 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 DOT 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.

Gaskets
Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.

Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6 o'clock, 3 – 9 o'clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60% full torque and two passes at full torque per ASME B16.5.

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 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.

System	Pressure	Medium	Duration
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. Die 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 Owner for review and approval. Provide sufficient notice to the A/E and/or Owner 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 pint 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 DOT 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 DOT 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.

As directed by engineer, the contractor will be required to open drain valves at selected locations in the system to verify the effectiveness of flushing procedures. If sediment or debris is identified in the system, it will be flushed again and reinspected at no expense to the State.

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 DOT that the systems are ready to be tested and balanced.
END OF SECTION 23 21 13

Section 23 21 23 - Hydronic Pumps

PART 1 - GENERAL

Scope
This section includes specifications for water pumps used for HVAC applications. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Base Mounted Centrifugal Pumps
- In-Line Centrifugal Pumps

PART 3 - EXECUTION
- Installation
- Base Mounted Pumps

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.

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

Base Mounted Centrifugal Pumps
Manufacturers:
Allis Chalmers, Aurora, Bell and Gossett, Taco, Peerless, Pacific, Armstrong, or approved equal.

Type:
Horizontal shaft, single stage, single or double suction, split casing, 175 psig working pressure at operating temperature of 225°F continuous, 250°F intermittent.

Casing:
Cast iron with suction and discharge gauge ports, renewable bronze wear rings, vent and drain plugs, flanged suction and discharge connections.

Impeller:
Bronze, hydraulically and dynamically balanced, keyed and locked to pump shaft, and protected by a replaceable bronze shaft sleeve.

Bearings:
Oil or grease lubricated ball or roller bearings.

Shaft:
Alloy steel with copper, bronze, or stainless steel shaft sleeve.

Seal:
Carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

Drive:
Flexible spacer type coupling or coupling with extended hub to allow for pump service. Provide guard for shaft/coupling assembly.

Baseplate:
Cast iron or fabricated steel with integral drain rim.

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.

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

Lubricate pumps before startup.

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.

Base Mounted Pumps

Set base mounted pumps on concrete bases, or concrete inertia base, level and bolt down prior to grouting. Fill the entire base with non-shrinking grout when required by the manufacturer's installation instructions.

Align all flexible coupled base-mounted pumps in accordance to the manufacturer's instructions.

Provide supports for elbows on pump suction and discharge piping 4" and over.

Provide air vent and drain valve on horizontal pump casings.

Provide drains for bases and seals, piped to and discharging into floor drains.

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Related Work
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria
- Maintenance Service

PART 2 - PRODUCTS
- Manufacturers
- System Cleaner
- System Inhibitor
- Algaecides
- Glycol
- Closed Water System Treatment
- Treatment Equipment
- Test Equipment

PART 3 - EXECUTION
- Preparation
- Cleaning Sequence
- Glycol Water Systems
- Closed Water Systems
- Appendix
- Pipe Cleaning and Treatment Report

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:

- Hot 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.

The chemicals used in the condenser water treatment system shall use only liquid chemicals and shall contain no phosphates or chromates.

Provide electrical devices, motors, wiring and conduit in accordance 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 seasonal 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 two 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.

System Inhibitor
Scale and corrosion inhibitor consisting of boron nitrite, benzol thiazol, benzotriazole, mercapto-benzo-thiazole, and tolyltrizole silicates.

Algaecides
Chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quaternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones, all in a liquid format.

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.

Closed Water System Treatment
Sequestering agent to reduce deposits and adjust pH: polyphosphate.

Corrosion inhibitors: boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.

Conductivity enhancers: phosphates or phosphonates.

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.

Solution Metering Pump:
Positive displacement, diaphragm pump with adjustable flow rate, thermoplastic construction, continuous-duty fully enclosed electric motor and drive, and relief valve.

Solution Tanks:
30 gallon capacity, polyethylene, self-supporting, 5 gallon graduated markings; molded fiberglass cover with recess for mounting pump, agitator, and liquid level switch.

Agitator:
Totally enclosed electric motor; stainless steel clamp, motor mount, and propeller.

Liquid Level Switch:
Polypropylene housing with integrally mounted polyvinylchloride air trap, receptacles for connection to metering pump, and low level alarm contact.

Sample Cooler:
Neptune Chemical Pump Co., Sentry Equipment Corp., or approved equal. Shell and coil heat exchanger specifically designed for sample cooling; constructed of 300 series stainless steel coil and shell; not less than one square foot of heat exchange surface; suitable for tube side conditions of pressure to 600 psig and temperature to 600°F with shell side conditions of 200 psig of cooling water at temperatures to 200°F maximum; removable shell for inspection and/or cleaning of the heat exchange surfaces; connections for cooling water inlet and outlet, steam inlet, and cooled condensate outlet.

Conductivity Controller:
Packaged monitor controller with solid state circuiting, five percent accuracy, linear dial adjustment, built-in calibration switch, on-off switch and light, control function light, output to control circuit.

Water Meter:
Displacement type cold water meter with sealed, tamper-proof magnetic drive, bronze housing, 125 psig minimum working pressure, impulse contact register when required by the sequence, single pole double throw dry contact switch. Meters must be capable of being used with remote readout heads and capable of being sealed to prevent tampering.

Solenoid Valves:
Forged brass body, globe pattern, normally open or closed as required, general purpose solenoid enclosure unless another type is recommended for the specific application, and continuous duty coil with voltage compatible with the remainder of the system

components. Use stainless steel body and trim in lieu of brass if brass is not compatible with valves installed in the lines handling the chemical treatment.

Timers:
Electronic timers, infinitely adjustable over full range of 150 seconds to five minutes, mounted together in cabinet with hand-off-automatic switches and status lights.

Hand Pump:
Rotary hand pump for dispensing fluid from shipping drums, corrosion resistant housing, steel suction pipe, polyethylene or polyvinylchloride discharge pipe, threaded fitting for connection to a 2" bung opening on the drum head. Hand pump to be capable of pumping against a head of 15 feet.

Test Equipment
Provide an enameled test cabinet with local fluorescent light, capable of accommodating a sufficient quantity of 10 milliliter burettes and associated reagents for the tests listed below.

Provide the following test kits:
- Alkalinity titration test kit
- Chloride titration test kit
- Sulphite titration test kit
- Total hardness titration test kit
- Low phosphate test kit
- Conductivity bridge, range 0 to 10,000 microhms
- Creosol red pH slide complete with reagent
- Portable electronic conductivity meter
- High nitrite test kit

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.

Use Division of State Facilities form to document system cleaning, flushing, and proper startup.

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.

CLOSED WATER SYSTEMS
Install a separate bypass type feeder at the pumps for each closed hot water heating and chilled water cooling system. Provide a separate set of supply and return lines from each pump in the system and install ball valves in each of these lines. Locate the system connection that supplies the feeder upstream of the discharge shutoff valve for the pump. Locate the system connection that returns treatment back to the system at a convenient point downstream of the pump discharge shutoff valve. Provide a drain valve at the bottom of the feeder.

Install a water meter upstream of the pressure reducing valve in the makeup line to each closed system. Locate the meter on the domestic water side of the pressure reducing valve and in such a manner that the meter can be easily read.
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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS
- General
- Materials
- Low Pressure Ductwork (Maximum 2 inch pressure class)
- Exhaust Duct (Moisture laden air)
- Duct Sealant
- Gaskets

PART 3 - EXECUTION
- Installation
- Low Pressure Duct (Maximum 2 inch pressure class)
- Exhaust Duct (Moisture laden air)
- Cleaning
- Leakage Test
- APPENDIX
- Duct Leakage Test Report
- Duct Structural Test Report

Related Work
23 33 00 – Air Duct Accessories
23 01 30.51 – HVAC Air Duct Cleaning
23 05 93 - Testing, Adjusting, and Balancing for HVAC

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 A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
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
ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials
ASTM C 1338 Test Method for Determining Fungal Resistance of Insulation Materials and Facings
ASTM G 21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM C 916 Standard Specification for Adhesives for Duct Thermal Insulation
NFPA 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:

- Fabrication and installation drawings.
- 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, 2nd Edition, 1995
- HVAC Air Duct Leakage Test Manual, 1st Edition, 1985
- HVAC Systems - Duct Design, 3rd Edition, 1990
- Rectangular Industrial Duct Construction Standard, 1st Edition, 1980
- Round Industrial Duct Construction Standards, 2nd Edition, 1999
- Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995
- Round Industrial Duct Construction Standards, 2nd Edition, 1999
- Rectangular Industrial Duct Construction Standards, 1st Edition, 1980

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, 2nd Edition, 1995.

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 in accordance to ASTM A90. Provide "Paint Grip" finish for ductwork that will be painted.

Low Pressure Ductwork (Maximum 2-inch pressure class)
Fabricate and install ductwork in sizes indicated on the drawings and in accordance to SMACNA recommendations, except as modified below.

Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance to SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

Where rectangular elbows are used, provide turning vanes in accordance to Section 23 33 00.

Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

Button punch snaplock construction will not be accepted on aluminum ductwork.

Round ducts may be substituted for rectangular ducts if sized in accordance to ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission of the Architect/Engineer.

Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

Duct Sealant
Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal and 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, in accordance to SMACNA HVAC Duct Construction Standards, Figure 2-7, 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 2-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or fume exhaust ductwork.

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.

Install prefabricated grease ductwork assemblies in accordance to manufacturer requirements and NFPA 96.

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 in accordance to SMACNA HVAC Duct Construction Standards, Figure 4-4, 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, in accordance 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 sheet metal 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.

Leakage Test
Test all ductwork in accordance to test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.

Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance to Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

Leakage rate shall not exceed more that 1% of the system air quantity for high pressure ductwork, determined in accordance to Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
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. Included are the following topics:

PART 1 - GENERAL
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS

Manual Volume Dampers
Turning Vanes
Fire Dampers
Control Dampers
Smoke Detectors
Access Doors
Flexible Duct
Duct Lining
Flashings
Duct Flexible Connections
Louvers

PART 3 - EXECUTION

Manual Volume Dampers
Turning Vanes
Fire Dampers
Control Dampers
Smoke Detectors
Access Doors
Flashings
Duct Flexible Connections
Louvers

Related Work

23 05 29 – Hanger and Supports for HVAC Piping and Equipment
23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
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 (6^{th} edition) Standard for Fire Dampers and Ceiling Dampers
UL 555S (4^{th} 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.

PART 2 - PRODUCTS

Manual Volume Dampers
Manufacturers: Ruskin, Vent Products, Air Balance, or approved equal.

Dampers must be constructed in accordance 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 in accordance 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 in accordance 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.

Dynamic Fire Dampers
Dynamic fire damper assemblies must be UL 555 (6th edition) listed and labeled for dynamic applications (where air systems operate during a fire) and meet requirements of NFPA 90A. Dampers must be type B curtain type with curtain 100% out of air stream. Dampers larger than 30" by 30" or with velocity rating requirements of 3000 fpm or higher, may be multiblade type with blades located in the airstream. Velocity ratings and static pressure ratings as indicated on the drawings. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

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 camp 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 in accordance 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 in accordance 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 wight of 26 ounces per square yard.

For corrosive environments or fume exhaust applications indoors or outdoors, use a material coated with Teflon that is air and water tight, suitable for temperatures between -20°F and 500°F, and has a nominal weight of 14 ounces per square yard.

Louvers
Manufacturers: Airolite K6776, Industrial Louvers 658, American Warming and Ventilating LE-31, or Construction Specialties 6177, 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 in accordance 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 in accordance 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.

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.

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 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.

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 in accordance 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.

LOUVERS
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 birdscreen, 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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- General
- Centrifugal Fans
- Utility Sets
- Mixed Flow In-line Fans
- In-line Centrifugal Fans
- Vaneaxial Fans
- Cabinet Fans
- Power Roof Exhaust Fans

Sidewall Centrifugal Fans
Sidewall Propeller Fans
Ceiling Exhaust Fans
Ceiling Destratification Fans

PART 3 - EXECUTION
Installation
Construction verification Items
Functional performance Testing
Agency Training

Related Work
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 05 13 - Common Motor Requirements for HVAC Equipment
Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and 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 in accordance 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.

Design Criteria
Tested and certify all fans in accordance 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 in accordance 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.

Use AMCA Type A spark resistant construction for all fans handling flammable or explosive vapors.

All fans handling grease laden vapors shall meet the requirements of UL 762 and NFPA 96.

Provide a corrosion resistant coating on all surfaces exposed to fume and other corrosive exhaust air. Coating to be as scheduled.

Centrifugal Fans
Manufacturers: PennBarry, Peerless, Buffalo, Carrier, Champion, Chicago Blower, Greenheck, New York Blower, Trane, Twin City, Cook, or approved equal.

Construct housing of welded steel with angle iron frame. Use spun or die formed inlet cones to provide a streamlined flow into the wheel. Use airfoil blades welded to spun wheel cones unless otherwise indicated. Shafts shall be AISI C 1045 hot rolled steel turned, ground and polished. Shaft shall be sized for at least 125% of the fans maximum cataloged RPM.

Bearings to be self-aligning grease packed pillow block type with grease seal and external grease fittings with a minimum L50 life of 200,000 hours at the maximum cataloged operating speed. Provide each fan housing with a capped drain connection and bolted and gasketed access door for inspection of fan wheel. Unless a special coating is scheduled, paint fans with a prime coat after metal cleaning and surface preparation; apply a second coat of paint to all exterior surfaces.

Fans shall bear the AMCA Certified Ratings Seal for Sound and Air Performance.

Provide one inch galvanized mesh inlet screens for fans without inlet ductwork.

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.

Sidewall Centrifugal Fans
Manufacturers: Carnes, Greenheck, Cook, Jenn-Air, ACME, Penn, or approved equal.

Dome type with spun aluminum housing, non-overloading centrifugal wheel, factory mounted and wired motor and disconnect switch housed in a separate ventilated compartment, belt or drive drive as scheduled, [24 volt electrically] [pneumatically] operated control damper with blade edge and jamb seals, damper operator, and birdscreen.

Ceiling Exhaust Fans
Carnes, Greenheck, Penn, Jenn-Air, Cook, ACME, or approved equal.

Centrifugal blower wheel, steel housing with acoustical lining, integral exhaust grille, adjustable mounting brackets to allow for any ceiling thickness, permanently lubricated motor, integral junction box with permanently lubricated and thermally protected motor factory wired, [24 volt electrically] [pneumatically] operated contol damper with blade edge and jamb seals, and damper operator.

Provide wall, eave, or roof discharge assembly, as indicated on the drawings.

Destratification Fans
BAF, Greenheck, or approved equal.

U.L. listed, all metal construction, baked enamel finish with factory standard color selected by Architect. Motors to be totally enclosed, impedance protected, single speed, of split capacitor design with permanently lubricated ball bearings.

Provide solid state variable speed controls as scheduled.

Motors to be reversible for summer/winter operation.

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 ½” fitting and leave open.

Install thrust restraints in accordance 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 37 13 - Diffusers, Registers and Grilles

PART 1 - GENERAL

Scope
This section includes specifications for air terminal equipment. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Submittals
- Design Criteria

PART 2 - PRODUCTS
- Manufacturers
- Square Ceiling Diffusers
- Side-Wall Registers and Grilles
- Eggcrate Grille
- Door Grille

PART 3 - EXECUTION
- Installation

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 Section 01 33 00 – Submittal Procedures

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 in accordance 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, or approved equal.

Acceptable manufacturers for specific products are listed under each item.

Square Ceiling Diffusers
Titus model TDC, Carnes series SK or SE, EH Price model AMD, Metal Aire series 5000 or 5500, 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.

Unless otherwise indicated, baked enamel finish with color selected by Architect.

Eggcrate Grille
Titus model 50, Carnes model RAE or RAT, EH Price model C80, 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. Unless noted otherwise, baked enamel finish with color selected by Architect.

Screw holes on surface counter sunk to accept recessed type screws.

Door Grille
Titus Series 700, Carnes Series RF or RG, Metal Aire Series DG

Aluminum (Steel). Sight tight.

Grille sizes, frame types, and finishes as shown on drawings and/or as scheduled. Unless noted otherwise, baked enamel finish with color selected by Architect.

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. User 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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Energy Efficiency
- Submittals
- Operation and Maintenance Data
- Registration

PART 2 - PRODUCTS
- Sealed Combustion Boiler, Condensing, Hi-efficiency, Modular

PART 3 - EXECUTION
- Installation
- Boilers
- Deaerator Assembly

Related Work
Section 23 21 13 – Hydronic Piping
Section 23 05 23 – General Duty Valves for HVAC Piping
Section 23 51 00 – Breeching, Chimneys and Stacks
Section 26 29 00 – Low Voltage Controllers

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 I - Rules of Construction of Power Boilers

ASME Boiler and Pressure Vessel Code VIII - Rules for Construction of Pressure Vessels
ASME Boiler and Pressure Vessel Code IX - Welding and Brazing Qualifications
ASME Boiler and Pressure Vessel Code I V - Rules for Construction of Heating Boilers
UL 296 Oil Burners
UL 795 Commercial Industrial Gas Heating Equipment
NFPA 70 Electrical wiring and devices
National Electric Code

Quality Assurance
Refer to division 1, General Conditions, Equals and Substitutions

Energy Efficiency
All boilers with a capacity of less than 300,000 btu/hr input must be labeled as Energy Star by its manufacturer.

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.

Registration
Complete Boiler and Unfired Pressure Vessel (UPV) Installation Registration and forward to the Department of Commerce in accordance to the Wisconsin Administrative Code Chapter Comm 41.24.

PART 2 - PRODUCTS

Sealed Combustion Boiler, Condensing, Hi-Efficiency, Modular
Manufacturers: Aerco, Fulton, Thermal Solutions, Laars, or RayPac, or approved equal.

Provide units with capacity and operating characteristics indicated on schedules.

Boiler ASME stamped for 160 psig and designed per ASME section IV. Furnish a relief valve in compliance with ASME section IV, and set at (100) psig. All internal combustion chamber, and internal burner components, shall be manufactured with materials suitable to withstand constant operation under condensing conditions. Combustion chamber shall have a condensate drain to discharge any condensate buildup.

Boiler efficiency 90%+ per ANSI Z21.13a, and operation in the condensing mode with inlet temperatures as low as 90 F.

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. Provide inlet/outlet combustion vent temperature fittings with direct outside air application

Category IV flu vent connection, condensing positive pressure, for both horizontal and sidewall venting. The vent outlet shall be compatible with, and used only with, type AL29-4C vent material.

Baked enamel finish boiler sheet metal jacket with removal panels for maintenance access.

Inlet and outlet temperature gauge to monitor inlet and outlet water temperatures.

Provide a water temperature controller.

Provide each boiler with a low water cutout operationally testable, manually reset on loss of low-water and auto-rest on loss of power in accordance to ASME Section IV and CSD-1.

Provide each boiler with dual over temperature protection, including manual reset, in accordance to ASME Section IV and CSD-1.

Provide remote fault alarm contact for flame sensor and high temperature limit failure.

Provide single point wiring for controls and fan.

Natural gas-fired burners, forced draft power type with a positive pressure at the boiler discharge. Stainless steel burner mixer. Maximum NOx emissions under 20 PPM.

Furnish units with fuel trains and operating controls conforming to the latest UL or equivalent agency approval, CSD-1 requirements, (and FM requirements)(and IRI requirements) Boiler/burner package shall be factory assembled, wired, mounted, and factory fire tested.

Provide a multiple boiler sequencing panel (BMS) capable of staging boilers to maintain peak seasonal efficiency. BMS shall include a sensor to monitor main loop system temperature, and a sensor to monitor outside air temperature. BMS shall be capable of outdoor reset, loop temperature span, and set loop temperature. BMS shall have the capability to stage boilers based on loop temperature and outdoor reset for highest operating seasonal efficiencies. BMS shall be capable of starting and stopping the system based on a remote contact closure, and have the ability to change setpoint from a remote location. Manufactures: Honeywell, Heat Timer, Techmar, or equivalent.

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.

If remote control panels are used, install all interconnecting wiring and pneumatic tubing if used between panels and units.

Boiler Blow Down Separators

Install separators on structural steel framework as shown. Extend vent line to atmosphere.

Install aftercooler, valves, piping specialties and associated piping including cold water piping from branch pipe provided by Plumbing Contractor.
END OF SECTION 23 52 00

Section 23 52 05 - Low Intensity Infrared Heaters

PART 1 - GENERAL

Scope
This section includes specifications for hot water and steam heating equipment. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Submittals
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Low Intensity Infrared Heaters

PART 3 - EXECUTION
- Installation
- Boilers
- Deaerator Assembly

Related Work
Section 23 51 00 – Breeching, Chimneys and Stacks

Reference
Applicable provisions of Division 1 govern work under this section.

Reference Standards
UL 795 Commercial Industrial Gas Heating Equipment
NFPA 70 Electrical wiring and devices
National Electric Code

Quality Assurance
Refer to division 1, General Conditions, Equals and Substitutions

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.

PART 2 - PRODUCTS

Low Intensity Infrared Heaters
Manufacturers: Sterling, Re-Verber-Ray, Superior Radian, or approved equal.

Radiant tube heaters shall be designed certified by CSA and comply with current occupational safety and health act (OSHA) requirements. The supplier shall provide the CSA certification number and the heaters shall bear the CSA seal of certification.

Heaters shall be equipped with a direct silicon carbide ignition system with a one-time ignition trial to sensing mode and an infinite trial after sensing mode. Power supplied to each burner shall be 120 VAC, 60 Hz.

Heater controls shall have independent flame rod sensing. The main burner shall be constructed of stainless steel. Heater controls shall include a safety differential pressure switch to monitor combustion airflow, so as to provide complete burner shutdown due to insufficient combustion air or flue blockage. The heater’s control system shall be designed to shutoff the gas flow to the main burner in the event a gas supply or power supply interruption occurs. The heater’s blower motor shall be thermally protected and the blower’s motor’s impeller shall be balanced. The heater’s air flow control system shall provide a 45 second pre-purge prior to initiating burner operation. No condensation shall form as a result of combustion in the combustion chamber or radiant tubes while at operating temperatures. And thermostat control shall be single-stage operating on 120 Volts.

Heater’s exterior control chassis shall be constructed of corrosion resistant enameled steel. The heater’s top cover shall be constructed of ABS plastic material and feature a protective rain guard suitable for use in harsh environments. Heater’s combustion chamber shall be 4 in. O.D. 16 ga. titanium stabilized aluminized steel, finished with a high emissivity rated (.95) corrosion resistant, black coating. Heater’s radiant emitter

tube(s) shall be 4 in. O.D. 16 ga. aluminized steel, finished with a high emissivity rated (.95) corrosion resistant, black coating.

Reflectors shall be .025 polished aluminum with a multifaceted design which includes reflector end caps. Reflectors shall be rotatable from 0 to 45 degrees when required. The heaters' reflector hanging system shall be designed to permit expansion while reducing noise and/ or rattles. Reflectors shall be assembled to the heater without the use of tools.

PART 3 - EXECUTION

Installation
Install units as shown on plans, as detailed, and according to manufacturer's installation instructions.

Radiant Heaters
Pipe vents from gas train to atmosphere. Size of each vent shall not be less than connection size to device.

Provide and install single-stage 120 VAC thermostat. All 120 VAC wiring by electrical contractor. Coordinate with electrical contractor all 120 VAC wiring prior to ordering equipment.

If remote control panels are used, install all interconnecting wiring between panels and units.
END OF SECTION 23 52 00

Section 23 55 00 - Water Source Heat Pump Units

Vertical Water Source Heat Pump
General:
Furnish and install ClimateMaster "Tranquility 30" Water Source Heat Pumps or approved equal to, as indicated on the plans. Equipment shall be completely assembled, piped and internally wired. Capacities and characteristics as listed in the schedule and the specifications that follow.

Horizontal / Vertical Water Source Heat Pumps:
Units shall be supplied completely factory built for an entering water temperature range from 20° to 120°F (-6.7° to 43.3°C) as standard. Equivalent units from other manufacturers can be proposed provided approval to bid is given 10 days prior to bid closing. All equipment listed in this section must be rated and certified in accordance to American Refrigeration Institute / International Standards Organization (ARI / ISO) and Environmental Testing Laboratories for United States and Canada (ETL-US-C). The units shall have ARI / ISO and ETL-US-C labels. All units shall be fully quality tested by factory run testing under normal operating conditions and water flow rates as described herein. Quality control system shall automatically perform via computer: triple leak

check, pressure tests, evacuate and accurately charge system, perform detailed heating and cooling mode tests, and quality cross check all operational and test conditions to pass/fail data base. Detailed report card will ship with each unit displaying all test performance data. Note: If unit fails on any cross check, system shall not be allowed unit to ship. Serial numbers will be recorded by factory and furnished to contractor on report card for ease of unit warranty status. Units tested without water flow are not acceptable.

Basic Construction:
Horizontal Units shall have one of the following air flow arrangements: Left Inlet/Straight (Right) Discharge; Right Inlet/Straight (Left) Discharge; Left Inlet/Back Discharge; or Right Inlet/Back Discharge as shown on the plans. Units must have the ability to be field convertible from straight to back or back to straight discharge with no additional parts or unit structure modification. Horizontal units will have factory installed hanger brackets with rubber isolation grommets packaged separately.

Vertical Units shall have one of the following air flow arrangements: Left Return/Top Discharge, Right Return/Top Discharge, Left Return/Bottom Discharge, Right Return/Bottom Discharge as shown on the plans.

If units with these arrangements are not used, the contractor is responsible for any extra costs incurred by other trades. All units (horizontal and vertical) must have a minimum of three access panels for serviceability of compressor compartment. Units having only one access panel to compressor/heat exchangers/expansion device/refrigerant piping shall not be acceptable.

Compressor section interior surfaces shall be lined with 1/2 inch (12.7mm) thick, dual density, 1-3/4 lb/ft^3 (28 kg/m^3) acoustic type glass fiber insulation. Air handling section interior surfaces shall be lined with 1/2 in (12.7mm) think, single density, 1-3/4 lb/ft^3 (28 kg/m^3) foil backed fiber insulation for ease of cleaning. Insulation placement shall be designed in a manner that will eliminate any exposed edges to prevent the introduction of glass fibers into the air stream. Units without foil backed insulation in the air handling section will not be accepted.

The heat pumps shall be fabricated from heavy gauge galvanized steel with powder coat paint finish. Both sides of the steel shall be painted for added protection.

Standard cabinet panel insulation must meet NFPA 90A requirements, air erosion and mold growth limits of UL-181, stringent fungal resistance test per ASTM-C1071 and ASTM G21, and shall meet zero level bacteria growth per ASTM G22. Unit insulation must meet these stringent requirements or unit(s) will not be accepted.

All horizontal units to have factory installed 1” (25.4mm) discharge air duct collars, 1” (25.4mm) filter rails with 1” (25.4mm) filters factory installed, and factory installed unit-mounting brackets. Vertical units to have field installed discharge air duct collar, shipped loose and 1” (25.4mm) filter rails with 1” (25.4mm) filters factory installed. If

units with these factory installed provisions are not used, the contractor is responsible for any extra costs to field install these provisions, and/or the extra costs for his sub-contractor to install these provisions.

All units must have an insulated panel separating the fan compartment from the compressor compartment. Units with the compressor in the air stream are not acceptable. Units shall have a factory installed 1 inch (25.4mm) wide filter bracket for filter removal from either side. Units shall have a 1 inch (25.4mm) thick throwaway type glass fiber filter. The contractor shall purchase one spare set of filters and replace factory shipped filters on completion of start-up. Filters shall be standard sizes. If units utilize non-standard filter sizes then the contractor shall provide 12 spare filters for each unit.

Cabinets shall have separate holes and knockouts for entrance of line voltage and low voltage control wiring. All factory-installed wiring passing through factory knockouts and openings shall be protected from sheet metal edges at openings by plastic ferrules. Supply and return water connections shall be copper IPT fittings, and shall be securely mounted flush to the cabinet corner post allowing for connection to a flexible hose without the use of a back-up wrench. Water connections that protrude through the cabinet or require the use of a backup wrench shall not be allowed. All water connections and electrical knockouts must be in the compressor compartment corner post as to not interfere with the serviceability of unit. Contractor shall be responsible for any extra costs involved in the installation of units that do not have this feature. Contractor must ensure that units can be easily removed for servicing and coordinate locations of electrical conduit and lights with the electrical contractor.

Fan and Motor Assembly:
Blower shall have inlet rings to allow removal of wheel and motor from one side without removing housing. Units shall have a direct-drive centrifugal fan. The fan motor shall be an ECM2 variable speed ball bearing type motor. The ECM2 fan motor shall provide soft starting, maintain constant CFM over its static operating range and provide airflow adjustment on its control board. The fan motor shall be isolated from the housing by rubber grommets. The motor shall be permanently lubricated and have thermal overload protection. A special dehumidification mode shall be provided to allow lower airflows in cooling for better dehumidification. The dehumidification mode shall be selectable via a jumper on the control board or may be controlled externally from a humidistat. Airflow / Static pressure rating of the unit shall be based on a wet coil and a clean filter in place. Ratings based on a dry coil and / or no filter, or on an ESP less than 0. 50 in w.g. (12.7 mm w.g.) shall NOT be acceptable.

Refrigerant Circuit:
All units shall contain HFC 410A sealed refrigerant circuit including a high efficiency Copeland UltraTech^{TM} two-stage compressor or approved equal designed for heat pump operation, a thermostatic expansion valve for refrigerant metering, an enhanced corrugated aluminum lanced fin and rifled copper tube refrigerant to air heat exchanger, reversing valve, coaxial (tube in tube) refrigerant to water heat exchanger, and safety

controls including a high pressure switch, low pressure switch (loss of charge), water coil low temperature sensor, and air coil low temperature sensor. Access fittings shall be factory installed on high and low pressure refrigerant lines to facilitate field service. Activation of any safety device shall prevent compressor operation via a microprocessor lockout circuit. The lockout circuit shall be reset at the thermostat or at the contractor supplied disconnect switch. Units that cannot be reset at the thermostat shall not be acceptable.

Hermetic compressors shall be internally sprung. The compressor shall have a dual level vibration isolation system. The compressor will be mounted on computer selected vibration isolation springs to a large heavy gauge compressor mounting tray plate, which is then isolated from the cabinet base with rubber grommets for maximized vibration attenuation. All units (except units with rotary compressors) shall include a discharge muffler to further enhance sound attenuation. Compressor shall have thermal overload protection. Compressor shall be located in an insulated compartment away from air stream to minimize sound transmission.

Refrigerant to air heat exchangers shall utilize enhanced corrugated lanced aluminum fins and rifled copper tube construction rated to withstand 625 PSIG (3101 kPa) refrigerant working pressure. Refrigerant to water heat exchangers shall be of copper inner water tube and steel refrigerant outer tube design, rated to withstand 625 PSIG (3101 kPa) working refrigerant pressure and 500 PSIG (3101 kPa) working water pressure. The refrigerant to water heat exchanger shall be “electro-coated” with a low cure cathodic epoxy material a minimum of 0.4 mils thick (0.4 – 1.5 mils range) on all surfaces. The black colored coating shall provide a minimum of 1000 hours salt spray protection per ASTM B117-97 on all external steel and copper tubing. The material shall be formulated without the inclusion of any heavy metals and shall exhibit a pencil hardness of 2H (ASTM D3363-92A), crosshatch adhesion of 4B-5B (ASTM D3359-95), and impact resistance of 160 in-lbs (184 kg-cm) direct (ASTM D2794-93).

Refrigerant metering shall be accomplished by thermostatic expansion valve only. Expansion valves shall be dual port balanced types with external equalizer for optimum refrigerant metering. Units shall be designed and tested for operating ranges of entering water temperatures from 20° to 120°F (-6.7° to 43.3°C). Reversing valve shall be four-way solenoid activated refrigerant valve, which shall default to heating mode should the solenoid fail to function. If the reversing valve solenoid defaults to cooling mode, an additional low temperature thermostat must be provided to prevent over-cooling an already cold room.

Drain Pan:
The drain pan shall be constructed of 304 Stainless Steel to inhibit corrosion. This corrosion protection system shall meet the stringent 1000 hour salt spray test per ASTM B117. If plastic type material is used, it must be HDPE (High Density Polyethylene) to avoid thermal cycling shock stress failure over the lifetime of the unit. Drain pan shall be fully insulated. Drain outlet shall be located at pan as to allow complete and unobstructed

drainage of condensate. Drain outlet for horizontal units shall be connected from pan directly to IPT fitting. No hidden internal tubing extensions from pan outlet extending to unit casing (that can create drainage problems) will be accepted. The unit as standard will be supplied with solid-state electronic condensate overflow protection. Mechanical float switches will NOT be accepted.

Vertical units shall be furnished with a PVC slip condensate drain connection and an internal factory installed condensate trap. If units without an internal trap are used, the contractor is responsible for any extra costs to field install these provisions, and/or the extra costs for his sub-contractor to install these provisions.

Electrical:
A control box shall be located within the unit compressor compartment and shall contain a 50VA transformer, 24 volt activated, 2 or 3 pole compressor contactor, terminal block for thermostat wiring and solid-state controller for complete unit operation. Reversing valve and fan motor wiring shall be routed through this electronic controller. Units shall be name-plated for use with time delay fuses or HACR circuit breakers. Unit controls shall be 24 Volt and provide heating or cooling as required by the remote thermostat / sensor.

Solid State Control System (CXM):
Units shall have a solid-state control system. **Units utilizing electro-mechanical control shall not be acceptable**. The control system microprocessor board shall be specifically designed to protect against building electrical system noise contamination, EMI, and RFI interference. The control system shall interface with a heat pump type thermostat. The control system shall have the following features:

1. Anti-short cycle time delay on compressor operation.
2. Random start on power up mode.
3. Low voltage protection.
4. High voltage protection.
5. Unit shutdown on high or low refrigerant pressures.
6. Unit shutdown on low water temperature.
7. Condensate overflow electronic protection.
8. Option to reset unit at thermostat or disconnect.
9. Automatic intelligent reset. Unit shall automatically reset the unit 5 minutes after trip if the fault has cleared. If a fault occurs 3 times sequentially without thermostat meeting temperature, then lockout requiring manual reset will occur.
10. Ability to defeat time delays for servicing.
11. Light emitting diode (LED) on circuit board to indicate high pressure, low pressure, low voltage, high voltage, low water/air temperature cut-out, condensate overflow, and control voltage status.
12. The low-pressure switch shall not be monitored for the first 120 seconds after a compressor start command to prevent nuisance safety trips.
13. 24V output to cycle a motorized water valve or other device with compressor contactor.

14. Unit Performance Sentinel (UPS). The UPS warns when the heat pump is running inefficiently.
15. Water coil low temperature sensing (selectable for water or anti-freeze).
16. Air coil low temperature sensing.

NOTE: Units not providing the 8 safety protections of anti-short cycle, low voltage, high voltage, high refrigerant pressure, low pressure (loss of charge), air coil low temperature cut-out, water coil low temperature cut-out, and condensate overflow protections will not be accepted.

Solid State ECM2 Fan Control Board:
Airflow selection shall be accomplished via 3 jumper switches on the ECM2 control board. Actual airflow shall be indicated by the CFM LED with each 100 CFM being represented by one flash of the LED. Airflow shall be automatically maintained (±5%) by the ECM2 motor regardless of external static pressure up to its maximum output capacity. A jumper shall allow selection of a special dehumidification mode, which reduces airflow in cooling by 25% to increase the latent capacity of the unit. A terminal shall be provided on the control board to allow an external humidistat to activate dehumidification mode.

Note: To achieve full benefit of the two-stage compressor and ECM2 fan, a 2 Heat / 2 Cool thermostat (or a 3 Heat / 2 Cool thermostat when electric backup heat is required) should be employed.

Remote Service Sentinel (CXM/DXM):
Solid state control system shall communicate with thermostat to display (at the thermostat) the unit status, fault status, and specific fault condition, as well as retrieve previously stored fault that caused unit shutdown. The Remote Service Sentinel allows building maintenance personnel or service personnel to diagnose unit from the wall thermostat. The control board shall provide a signal to the thermostat fault light, indicating a lockout. Upon cycling the G (fan) input 3 times within a 60 second time period, the fault light shall display the specific code as indicated by a sequence of flashes. A detailed flashing code shall be provided at the thermostat LED to display unit status and specific fault status such as over/under voltage fault, high pressure fault, low pressure fault, low water temperature fault, condensate overflow fault, etc. **Units that do not provide this remote service sentinel shall not be acceptable.**

Option: Lonworks interface system
Units shall have all the features listed above (either CXM or DXM) and the control board will be supplied with a LONWORKS interface board, which is LONMark certified. This will permit all units to be daisy chained via a 2-wire twisted pair shielded cable. The following points must be available at a central or remote computer location:

1. Space temperature .
2. Leaving water temperature.
3. Discharge air temperature.
4. Command of space temperature setpoint.

5. Cooling status.
6. Heating status.
7. Low temperature sensor alarm.
8. Low pressure sensor alarm.
9. High pressure switch alarm.
10. Condensate sensor alarm.
11. Hi/low voltage alarm.
12. Fan "ON/AUTO" position of space thermostat as specified above.
13. Unoccupied / occupied command.
14. Cooling command.
15. Heating command.
16. Fan "ON / AUTO" command.
17. Fault reset command.
18. Itemized fault code revealing reason for specific shutdown fault (any one of 7).

This option also provides the upgraded 75VA control transformer with load side short circuit and overload protection via a built in circuit breaker.

Field Installed Options

Hose Kits:

All units 120000 BTUH (35 kW) and below shall be connected with hoses. The hoses shall be 2 feet (61cm) long, braided stainless steel; fire rated hoses complete with adapters. Only fire rated hoses will be accepted.

Valves:

The following valves are available and will be shipped loose:

1. Ball valve; bronze material, standard port full flow design, IPT connections.
2. Ball valve with memory stop and PT Port; standard port full flow design, IPT connections.
3. “Y” strainer with cap; bronze material, IPT connections.
4. “Y” strainer with blowdown valve; bronze material, IPT connections.
5. Motorized water valve; slow acting, 24v, IPT connections.

Hose Kit Assemblies:

The following assemblies ship with the valves already assembled to the hose described:

1. Supply and return hoses having ball valve with PT port.
2. Supply hose having ball valve with PT port; return hose having automatic flow regulator valve (Measureflo) with PT ports, and ball valve.
3. Supply hose having “Y” strainer with blowdown valve, and ball valve with PT port; return hose having automatic flow regulator (Measureflo) with PT ports, and ball valve.

Thermostats:

The thermostat shall be a ClimateMaster mechanical or electronic type thermostat as selected below with the described features:

1. Single Stage Digital Auto or Manual Changeover (ATA11U01), digital, auto or manual changeover with HEAT-OFF-COOL-AUTO system switch and fan ON_AUTO switch. Thermostat shall have an LCD display with temperature and set-point(s) in ºF or ºC. The Thermostat shall provide permanent memory of set-point(s) without batteries. A fault LED shall be provided to display specific fault condition. Thermostat shall provide temperature display offset for custom applications.

2. Water-to-Water Heat Pump
   General:
   Units shall be Underwriter Laboratory (UL) listed for safety on all models. Each unit shall be run tested at the factory. Each unit shall be pallet mounted and stretch wrapped.

The units shall be warranted by the manufacturer against defects in materials and workmanship for a period of one year on all parts, and 5 years on the compressor. The units shall be manufactured in an ISO 9001:2000 certified facility.

The units shall be designed to operate with entering fluid temperatures between 20 def F and 120 deg F as manufactured by FHP Manufacturing and shall be R-410A.

Casing and Cabinet
The cabinet shall be fabricated from heavy-gauge steel finished with galvalume plus, an aluminum-zinc alloy with a clear acrylic coating for additional corrosion protection. The interior shall be insulated with ½" thick, multi density, coated, glass fiber. All units shall allow sufficient service access to replace the compressor without unit removal.

Refrigeration Circuits
All units shall contain a sealed refrigerant circuit including a hermetic scroll compressor, bidirectional thermal expansion valve metering device, coaxial style fluid-to-refrigerant heat exchangers, refrigerant reversing valve and service ports. Compressor shall be high efficiency, designed for heat pump duty with refrigerant R-410A, and mounted on rubber vibration isolators. Compressor motors shall be equipped with overload protection. Refrigerant reversing valves shall be pilot operated sliding position type with replaceable encapsulated magnetic coils energized only during the chiller cycle. The coaxial water-to-refrigerant heat exchanger shall be constructed of a convoluted copper inner tube and steel outer tube with a designed refrigerant working pressure of 600 PSIG and a designed water side working pressure of no less than 400 PSIG. Due to their susceptibility to fouling, brazed plate heat exchangers are not acceptable. The fluid-to-refrigerant heat exchangers shall be insulated to prevent condensation at low fluid temperatures.

Electrical
Controls and safety devices will be factory wired and mounted within the unit. Controls shall include, compressor contactor, 24V transformer, reversing valve coil and solid state

lockout controller (UPM). Safety devices include a low pressure cutout set at 20 PSIG for loss of charge protection (freezestat and/or high discharge gas temperature sensor is not acceptable) and a high pressure cutout control set at 600 PSIG.
END OF SECTION 23 55 00

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Related Work
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Air-to-Air Heat Exchangers (Rotary wheel type)

PART 3 - EXECUTION
- Installation
- Air-to-Air Heat Exchangers (Rotary wheel type)

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.

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.

Design Criteria
Capacity, efficiency, and operating characteristics as indicated on the drawings and/or as scheduled.

PART 2 - PRODUCTS

Air-To-Air Heat Exchangers With Heating
Manufacturers:
Greenheck, Air X-Change, Des Champs, Annexair, or approved equal.

General:
Energy Recovery Ventilator shall be as manufactured by "Greenheck" or approved equal provided all specifications are met. Greenheck Model ERH is used as the basis of design. Units shall be listed per ANSI/UL 1995, Heating and Cooling Equipment. Energy transfer ratings of the energy recovery wheel shall be ARI Certified. Ventilators shall bear the AMCA Certified Rating Seals for Air Performance. Performance shall be as scheduled on plans. Exhaust discharge and outside air intake shall not be located on the same side on roof top units.

Energy Recovery Wheel:
Wheel shall be of the enthalpy type for both sensible and latent heat recovery and be designed to ensure laminar flow. Energy transfer ratings must be ARI Certified to Standard 1060 and bear the ARI certification symbol for ARI Air-to-Air Energy Recovery Ventilation Equipment Certification Program based on ARI 1060. Ratings "in accordance to 1060" without certification are not acceptable. Desiccant shall be silica gel for maximum latent energy transfer. Wheel shall be constructed of lightweight polymer media to minimize shaft and bearing loads. Polymer media shall be mounted in a stainless steel rotor for corrosion resistance.

Wheel design shall consist of removable segments for ease of service and/or cleaning. Silica gel desiccant shall be permanently bonded to wheel media to retain latent heat capability after cleaning. Wheels with sprayed on desiccant coatings are not acceptable. Wheels with desiccant applied after wheel formation are not acceptable. Energy recovery device shall transfer moisture entirely in the vapor phase.

Energy recovery drive belt material shall be high strength urethane and shall be factory installed in a pre-stretched state, eliminating the need for field belt tension adjustment. Link style belts are not acceptable.

Chemical Resistance Coating:
In addition to the desiccant or polymer coatings applied to the media substrate, the two faces of the energy wheel shall be covered and sealed with a heavy duty coating specifically chosen for chemical resistance.

Casing:
Unit shall be of internal frame type construction of galvanized steel. Frame and panels shall be G90 galvanized steel. All panels exposed to the weather shall be a minimum of 18 gauge galvanized steel. Unit shall be internally lined with galvanized sheet metal creating a double wall. Where top panels are joined there shall be an overlapping, standing seam to ensure positive weather protection. All metal-to-metal seams shall be factory sealed, requiring no caulking at job site. Permatector exterior finish is available for outdoor units.

Unit base to be designed for curb mounting. Unit base shall overhang the curb for a positive seal against water run-off.

Indirect Gas:
Indirect fired gas furnace shall be 80% efficient, ETL Listed for Indoor and Outdoor installation to ANSI Standard Z83.8 - 2002, CGA approved per 2.6 - 2002 and have a blow through fan design. Furnace shall be capable of operation with natural gas or LP gas and have a power venting system. The burner and heat exchanger shall be constructed of aluminized steel. Standard furnace features shall include main gas pressure regulator, main gas valve, electronic staged or electronic modulating controls, direct spark ignition system, high limit and a 24-volt control transformer.

Drive:
Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy-duty type, matched to the fan load and furnished at the specified voltage, phase, and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast type, keyed and securely attached to the fan wheel and motor shafts; 10 horsepower and less shall be supplied with an adjustable drive pulley. Energy wheel motors shall have integral overload protection.

Filters:
Supply and exhaust air filters shall be 2-inch thick pleated fiberglass, 30% efficient and tested to meet UL Class 2. Filter racks shall be die-formed galvanized steel.

Electrical:
All internal electrical components shall be factory wired for single point power connection. Units with electric reheat will be wired with independent power supply. All electrical components shall be UL Listed, Approved, or Classified where applicable and wired in compliance with the National Electrical Code.

Weatherproof, integral door interlocking disconnect switch, motor starters, control circuit fusing, control transformer for 24 VAC circuit, and terminal strip shall be supplied as standard components in the control center. Motor starters consist of a contactor and Class 20 electronic adjustable overload protection and shall be provided for all motors in the unit.

Air-To-Air Heat Exchangers (Erv)
Manufacturers:
Greenheck, Air X-Change, Des Champs, Annexair, or approved equal.

General:
Energy Recovery Ventilator shall be as manufactured by Greenheck or approved equal, provided all specifications are met. Greenheck Model MiniVent equipment is used as the basis of design. Units shall be listed per ANSI/UL 1995, Heating and Cooling Equipment. Energy transfer ratings of the energy recovery wheel shall be ARI Certified. Ventilators shall bear the AMCA Certified Rating Seals for air performance. Performance to be as scheduled on plans.

The MiniVent-450 and 750 are energy recovery ventilators for commercial and institutional applications that require 300 cfm to 800 cfm of ventilation air. The compact design provides an economical solution for individual spaces, such as school classrooms and small offices.

The MiniVent is designed for indoor installations and may be floor mounted or ceiling hung. A removable panel enables easy access to filters and enthalpy wheel. Pleated 1 inch deep filters and backdraft dampers are standard.

PART 3 - EXECUTION

Installation
Install units in accordance to unit manufacturer's installation requirements in locations indicated on the drawings and as detailed.

Install "filter" gauges for both airstreams to measures air pressure drop through unit while in operation;

Install thermometers in both supply and exhaust airstreams at inlet and outlet connections to units;

Air-To-Air Heat Exchangers (Rotary wheel type)
Install filter rack with panel filters where supply and exhaust airstreams enter units if units do not already have filters provided or installed. Pipe condensate drain pan to the nearest floor drain.
END OF SECTION 23 72 00

END OF DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING

60. SWEF Building, Electrical, SPV.0105.17.

A Description
This item consists of the electrical work for the SWEF building. The work shall be in accordance to the applicable plans and the following specifications.

B (Vacant)

C (Vacant)

D Measurement
The department will measure SWEF Building, Electrical 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.0105.17	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.

Project Overview
The electrical contractor is to furnish and install all work shown on the electrical drawings and leave in operating order, and make all connections to plumbing and HVAC equipment provided by others.

Scope
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:

PART 1 - GENERAL
- Project Overview
- Scope
- Related Work
- Reference Standards
- Regulatory Requirements
- Quality Assurance
- Protection of Finished Surfaces
- Approved Electrical Testing Laboratories
- Sleeves and Openings
- Sealing and Firestopping
- Intent
- Omissions
- Submittals
- Project/Site Conditions
- Work Sequence and Scheduling
- Work by Other Trades
- Offsite Storage
- Request and Certificate for Payment
- Salvage Materials
- Certificates and Inspections
- Operating and Maintenance Data
- Record Drawings

PART 2 - PRODUCTS
- Access Panels and Doors
- Identification
- Sealing and Firestopping

PART 3 - EXECUTION
- Excavation and Backfill
- Concrete Work
- Cutting and Patching
- Building Access
- Equipment Access
- Coordination
- Sleeves
- Sealing and Firestopping
- Housekeeping and Clean Up
- Agency Training

Related Work
Applicable provisions of Division 1 govern work under this section.

Reference Standards
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.

Regulatory Requirements
All work and materials are to conform in every detail to applicable rules and requirements of the Wisconsin State Electrical Code Volumes 1 and 2, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).

All Division 26 work shall be done under the direction of a currently certified State of Wisconsin Certified Master Electrician.

Quality Assurance
Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.

Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by DOT, 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, except for medium voltage equipment and components, shall be so labeled.

Protection Of Finished Surfaces
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.

Approved Electrical Testing Laboratories
The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:

Underwriters Laboratories Inc.
Electrical Testing Laboratories, Inc.

Sealing And Firestopping
Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, 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.

Intent
The contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.

If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the specifications or exists within the drawings, the contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits the DOT's intent (as determined by the DOT Project Manager). Refer to the General Conditions of the Contract for further clarification.

It must be understood that the details and drawings are diagrammatic. The contractor shall verify all dimensions at the site and be responsible for their accuracy.

All sizes as given are minimum except as noted.

Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the DOT's and/or A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

Omissions
No later than ten days before bid opening, the contractor shall call the attention of the DOT to any materials or apparatus the contractor believes to be inadequate and to any necessary items of work omitted.

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. 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.

On request from the DOT, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

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.

The submittals must be approved before fabrication is authorized.

Submit sufficient quantities of submittals to allow the following distribution:

Operating and Maintenance Manuals	2 copies
User agency	2 copies
A/E	1 copy
DOT Field Office	1 copy

Project/Site Conditions
Install Work in locations shown on drawings, unless prevented by project conditions.

Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of DOT before proceeding.

Tools, materials and equipment shall be confined to areas designated by the DOT and user agency.

Work Sequence And Scheduling
Install work in phases to accommodate user agency's occupancy requirements. During the construction period coordinate electrical schedule and operations with DOT's construction representatives.

Work By Other Trades
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.

Electrical details on drawings for equipment to be provided by others is 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.

Offsite Storage
If payment will be requested for approved offsite stored material, then the contractor shall complete an "Off-site Storage Agreement" which is available from the DOT. Prior approval by DOT personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

Request And Certificate For Payment
Within 10 days after Notice to Proceed, the successful bidder shall submit to the DOT in a form prescribed below and by the General Conditions of the Contract, Scheduling and Coordination of Work, Reports, Records and Data, and Payments to contractor, a cost breakdown of the proposed values for work performed which, if approved by the DOT, 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 will be requested for approved off-site stored material, then that material shall be listed as a line item and the contractor shall complete an "Off-site Storage Agreement" which is available from the DOT.

Certificates And Inspections
Obtain and pay for all required State installation inspections except those provided by the DOT in accordance to Wis. Adm. Code Section Comm. 61.30. Deliver originals of these certificates to the DOT's Project Representative.

This contractor is responsible for coordination of DOT electrical inspection. Inspection requirements will be issued at a pre-installation meeting, arranged by this contractor and the DOT Electrical Inspector (See Article 15 of the General Conditions).

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. Manufacturer’s wiring diagrams for electrically powered equipment.

Record Drawings
The contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.

The DOT 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.

The daily record of changes shall be the responsibility of contractor's field superintendent. No arbitrary mark-ups will be permitted.

At completion of the project, the contractor shall submit the marked-up record drawings to the DOT prior to final payment.

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 other divisions 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 other divisions.

Metal Pan Ceilings:
Removable sections of ceiling tile held in position by pressure fit will be provided under other divisions.

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".

Identification
See Electrical section 26 05 53 – Identification for Electrical Systems.

Sealing And Firestopping
Fire And/Or Smoke Rated Penetrations:
Manufacturers:
3M, STI/SpecSeal, Tremco, Hilti or approved equal.

All firestopping systems shall be 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 judgment can be based upon.

Product:
Firestop 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 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:
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 a water-stop type wall sleeve.

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

Excavation And Backfill
Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance to section 31 23 16.13 - Trenching. Blasting will not be allowed without written permission of the DOT.

Concrete Work
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.

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. 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.

Coordination
The contractor shall cooperate with other trades and DOT's personnel 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 to the DOT, provided such decision is reached prior to actual installation. The contractor shall check location of electrical outlets with respect to other installations before installing.

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.

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 testing consultant in ensuring specification section 26 05 04 compliance. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing contractor can perform its work.

Sleeves
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.

In wet area floor penetrations, top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert 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.

Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.

Sealing And Firestopping
Fire and/or Smoke Penetrations:
Install approved product in accordance to the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.

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 Surfaces:
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.

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.

In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance 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.

At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. 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.

Housekeeping And Clean Up
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.

Agency Training
All training provided for agency shall comply with the format, general content requirements.

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 8 hours.
END OF SECTION 26 05 00

Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cable

PART 1 - GENERAL

Scope
The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Project Conditions

PART 2 - PRODUCTS
- General
- Building Wire
- Underground Wire for Exterior Work
- Modular Wiring Systems - Light Fixtures
- Modular Wiring Systems - Receptacles
- Wiring Connectors

PART 3 - EXECUTION
- General Wiring Methods
- Wiring Installation In Raceways
- Modular Wiring System Installation
- Wiring Connections and Terminations
- Field Quality Control

Wire Color
Branch Circuits
Emergency Circuits

Related Work
Applicable provisions of Division 1 govern work under this section.

Section 26 05 33 – Raceway and Boxes for Electrical Systems
Section 26 05 53 – Identification for Electrical Systems

References
NFPA 70 - National Electrical Code

Submittals
Submit product data: Provide for each cable assembly type.

Submit factory test reports: Indicate procedures and values obtained.

Submit shop drawings for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.

Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

Project Conditions
Verify that field measurements are as shown on drawings.

Conductor sizes are based on copper.

Wire and cable routing shown on drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

General
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.

All conductors shall be copper. Aluminum conductors size #1/0 and larger may be substituted for copper. The following requirements shall be met when aluminum conductors are used:

Aluminum alloy conductors shall be compact stranded conductors of a recognized Aluminum Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy).

It is the responsibility of the contractor to increase the size of the conduit, wire gutter, or enclosure, if necessary, to accommodate the aluminum conductors and meet allowable code requirements.

It is the responsibility of the contractor to increase the size of the aluminum conductor to match the ampacity of the copper conductor circuit shown on the drawings.

The contractor shall submit a feeder schedule to the engineer for all conductor substitutions indicating the aluminum conductor wire size and the conduit size. The contractor shall not begin the installation until written approval is granted by the engineer.

All aluminum conductors shall terminate on a mechanical screw-type connector or mechanical compression-type connector. Connector shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors, and sized to accept aluminum conductors of the required ampacity. When using compression-type connectors, the lugs shall be marked with wire size, die index, number and location of crimps and shall be suitably color-coded. Using a suitable stripping tool, remove insulation from the required length of the conductor. Wire brush the conductor and apply a Listed joint compound. Tighten or crimp the connection per the connector manufacturer's recommendation. Wipe off any excess joint compound.

When terminating aluminum conductors to aluminum bus, prepare a mechanical screw-type or compression-type connection. Bolts shall be anodized alloy and conform to current ANSI and ASTM chemical and mechanical property limits. Nuts shall be aluminum alloy and conform to current ANSI standards. Washers shall be flat aluminum alloy, Type A plain, standard wide series conforming to current ANSI standards. Lubricate and tighten the hardware per manufacturer's recommendations.

When terminating aluminum conductors to copper bus, prepare a mechanical screw-type or compression-type connection. Bolts shall be plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to current ASTM standard or SAE grade 5. Nuts shall conform to current ANSI standards. Washers shall be steel, Type A plain, standard wide series conforming to current ANSI standards. Belleville conical spring washers shall be of hardened steel, cadmium plated or silicone bronze. Lubricate and tighten the hardware per manufacturer's recommendations.

The contractor shall perform an infrared survey of all aluminum conductor connections after the installation is complete and in normal service. Infrared surveys shall be performed during periods of maximum possible loading with at least 30% of rated load of

the equipment being inspected. All connections with elevated temperatures shall be corrected by the contractor. The infrared survey results shall be provided in report form, in the completed O&M manuals.

No copper-to-aluminum transitions permitted when splicing onto existing copper feeders.

Insulation shall have a 600 volt rating.

All conductors shall be stranded.

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.

Building Wire
Description: Single conductor insulated wire.

Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits.
Type XHHW-2 insulation for feeders with aluminum conductors.

Underground Wire For Exterior Work
Description: Stranded single or multiple conductor insulated wire.

Insulation: Type XHHW-2 or USE.

This wiring shall be used in all underground applications, except when run in a concrete-encased ductbank.

Wiring Connectors
Split Bolt Connectors: Not acceptable.

Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.

Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

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.

Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

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.

PART 3 - EXECUTION

General Wiring Methods

All wire and cable shall be installed in conduit.

Do not use wire smaller than 12 AWG for power and lighting circuits.

All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).

Make conductor lengths for parallel conductors equal.

Splice only in junction or outlet boxes.

No conductor less than 10 AWG shall be installed in exterior underground conduit.

Identify ALL low voltage, 600v and lower, wire per section 26 05 53.

Neatly train and lace wiring inside boxes, equipment, and panelboards.

Wiring Installation In Raceways

Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.

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.

Completely and thoroughly swab raceway system before installing conductors.

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.

Wiring Connections And Terminations

Splice only in accessible junction boxes.

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.

All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

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 conductor.

Thoroughly clean wires before installing lugs and connectors.

At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

Field Quality Control
Field inspection and testing will be performed under provisions of Section 26 05 04.

Additional testing as follows shall be performed if aluminum conductors are used:

Equipment terminated with aluminum conductors shall be tested with a thermal imager and recorded.

Conductors shall be closely checked for loose or poor connections, and for signs of overheating or corrosion.

Test procedures shall meet NETA guidelines.

Test results and report shall be provided to the engineer.

Contractor shall correct all deficiencies reported in the test report.

Wire Color
General:
For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.

For wire sizes 8 AWG and larger – Use colored wire, or identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.

In existing facilities, use existing color scheme.

In new facilities, use black and red for single phase circuits at 120/240 volts, use Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase, and use Phase A brown, Phase B orange and Phase C yellow for circuits at 277/480 volts single or three phase. Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.

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.

Neutral Conductors: White for 120/208V and 120/240V systems, Gray for 277/480V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with a different stripe.

Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.

Feeder Circuit Conductors: Each phase shall be uniquely color coded.

Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green colored wire, or 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.

Branch Circuits
The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

Emergency Circuits
All emergency system wiring (level 1 and level 2) 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.
END OF SECTION 26 05 19

Section 26 05 26 - Grounding and Bonding for Electrical Systems

PART 1 - GENERAL

Scope
The work under this section includes grounding electrodes and conductors, equipment grounding conductors, and bonding. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Performance Requirements
- Submittals
- Project Record Documents
- Regulatory Requirements

PART 2 - PRODUCTS
- Rod Electrode
- Mechanical Connectors
- Compression Connectors
- Exothermic Connections
- Wire
- Bus

PART 3 - EXECUTION
- Examination
- General
- Medium Voltage System Grounding
- Less Than 600 Volt System Grounding
- Field Quality Control

Related Work
Applicable provisions of Division 1 govern work under this Section.

References
NFPA 70 - National Electrical Code.
ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

Performance Requirements
Grounding System Resistance: 2ohms maximum at building service entrance.

Testing of grounding system resistance is to be witnessed by the DOT electrical inspector or Field Representative. Provide test report of grounding system resistance in final O&M manuals.

Submittals
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.

Project Record Documents
Accurately record actual locations of grounding electrodes.

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

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.

Mechanical Connectors
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. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.

The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

Compression Connectors
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.

Exothermic Connections
As manufactured by Cadweld or similar.

Wire
Material: Stranded copper (aluminum not permitted).

Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

Primary 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.

Bus
Material: Copper (aluminum not permitted).

Size: 1/4" X 2" minimum.

PART 3 - EXECUTION

Examination
Verify that final backfill and compaction has been completed before driving rod electrodes.

General
Install Products in accordance 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.

Attach grounds permanently before permanent building service is energized.

All grounding electrode conductors shall be installed in PVC conduit, in exposed locations.

Less Than 600 Volt System Grounding
Supplementary Grounding Electrode: Use driven ground rod on exterior of building.

Provide code sized copper grounding electrode conductor from secondary switchboard 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.

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.

Install ground grid under access floors where indicated. Construct grid of #4 AWG bare copper wire installed on 72 inch centers both ways. Bond each access floor support pedestal to grid.

Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Use #4 AWG bare copper conductor.

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.

Provide communications system grounding conductor at point of service entrance and connect to building common grounding electrode system.

Telecommunications and Audio Visual systems shall be installed with an isolated grounding system which has only one ground point. That ground point is to be the common grounding electrode system at the electrical service entrance for the building. Contractor is to provide an isolated grounding conductor from the electrical service entrance of the building to each Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room. Use a minimum No. 2/0 AWG copper conductor, or as indicated on the plans, for the telecommunications service grounding conductor. Leave 10 feet slack grounding conductor at each Telecommunications Room. The grounding conductor MUST NOT be attached to building steel (except as allowed at the main electrical service entrance).

Telecommunications Equipment Rack Grounding: Use a #6 or larger AWG copper conductor from all telecommunications cabinets and racks to the Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room.

Field Quality Control
Inspect grounding and bonding system conductors and connections for tightness and proper installation.
END OF SECTION 26 05 26

Section 26 05 29 - Hangers and Supports for Electrical Systems

PART 1 - GENERAL

Scope
The work under this sections includes conduit and equipment supports, straps, clamps, steel channel, etc, and fastening hardware for supporting electrical work. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals
- Quality Assurance

PART 2 - PRODUCTS
- Material

PART 3 - EXECUTION
- Installation

Related Work
Applicable provisions of Division 1 govern work under this Section.

Submittals
Product Data: Provide data for support channel.

Quality Assurance
Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

Material
Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.

Hardware: Corrosion resistant.

Minimum sized threaded rod for supports shall be 3/8” for trapezes and single conduits 1-1/4” and larger, and ¼” for single conduits 1” and smaller.

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

Installation

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).

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.

Power-actuated fasteners and plastic wall anchors are not permitted.

File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.

Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.

Do not drill structural steel members unless approved by DOT.

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.

In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5 inch (89 mm) concrete pads.

Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch (25 mm) off wall (7/8” Uni-strut or ¾” painted, fire-retardant plywood is acceptable).

Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

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

SCOPE
The work under this section includes conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, wall duct, and boxes for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals

PART 2 - PRODUCTS
- Rigid Metal Conduit and Fittings
- Electrical Metallic Tubing (EMT) and Fittings
- Flexible Metal Conduit and Fittings
- Liquidtight Flexible Metal Conduit and Fittings
- Electrical Nonmetallic Tubing (ENT) and Fittings
- Rigid Nonmetallic Conduit and Fittings
- Conduit Supports
- Auxiliary Gutters (Wireways)
- Outlet Boxes
- Floor Boxes
- Pull and Junction Boxes
- General

PART 3 - EXECUTION
- Conduit Sizing, Arrangement and Support
- Conduit Installation
- Conduit Installation Schedule
- Nonmetallic Surface Raceway Installation
- Auxiliary Gutters (Wireways) Installation
- Coordination of Box Locations
- Outlet Box Installation
- Floor Box Installation
- Pull and Junction Box Installation

Related Work
Applicable provisions of Division 1 govern work under this section.

Section 26 05 29 – Hangers and Supports for Electrical Systems.
Section 26 27 26 – Wiring Devices.
Section 26 27 02 – Equipment Wiring Systems.
Section 28 31 00 – Fire Detection and Alarm.
Section 27 00 00 – Communications Cable and Equipment.

Submittals
Surface Raceway System - submit product data and catalog sheets for all components.

Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 - PRODUCTS

Rigid Metal Conduit And Fittings
Conduit: Heavy wall, galvanized steel, schedule 40, threaded.

Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

Electrical Metallic Tubing (Emt) And Fittings
Conduit: Steel, galvanized tubing.

Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.
Conduit Bodies: All steel threaded conduit bodies.

Flexible Metal Conduit And Fittings
Conduit: steel, galvanized, spiral strip.

Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 26 51 13).

Liquidtight Flexible Metal Conduit And Fittings
Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

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.

Electrical Nonmetallic Tubing (Ent) And Fittings
Conduit: ENT (smurf tube), UL listed and NEC recognized.

Fittings: One piece quick connect fittings for 1/2 inch to 1 inch size and schedule 40 cemented fittings for larger size. When installed in concrete, fittings shall be suitable for damp locations and shall be concrete–tight, stub-ups and stub-downs kits shall meet manufacturer's recommendations.

Rigid Nonmetallic Conduit And Fittings
Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90^0 C conductors.

Fittings and Conduit Bodies: NEMA TC 2, Listed.

Conduit Supports
See section 26 05 29.

Auxiliary Gutters (Wireways)
Description: [General purpose] [Oil-tight and dust- tight] [Rain-tight] type wireway without knockouts.

Size: 6 x 6 inch As indicated on drawings; length as indicated on drawings.

Cover: Hinged cover with full gasketing.

Connector: Flanged; hinged cover.

Fittings: Lay-in type with removable top, bottom, and side; captive screws. drip shield.

Finish: Rust inhibiting primer coat with gray enamel finish.

Outlet Boxes
Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.

Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.

Concrete Ceiling Boxes: Concrete type.

Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.

Floor Boxes
Floor Boxes for Installation in Cast-In-Place Concrete Floors: Full adjustable

Pull Boxes And Junction Boxes
Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 $1/8^{th}$ 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 or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).

For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4" and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.

Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

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.

Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations.

Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.

Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.

Wireways shall not be used in lieu of junction boxes.

General
All steel fittings and conduit bodies shall be galvanized.

No cast metal, or split-gland type fittings permitted.

Mogul-type condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.

All condulet covers must be fastened to the condulet body with screws and be of the same manufacture.

Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.

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

Conduit Sizing, Arrangement, And Support
EMT is permitted to be used in sizes 4" (50 mm) and smaller for power and telecommunication systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.

Size power conductor raceways for conductor type installed. Conduit size shall be ½ inch (13 mm) minimum except **all homerun conduits shall be ¾",** 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.**

Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.

Arrange conduit to maintain headroom and present a neat appearance.

Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

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.

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.

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.

Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.

Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.

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.

In general, all conduit shall be concealed except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.

Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.

For indoor conduits, no continuous conduit run shall exceed 100 feet (30 meters) without a junction box.

All conduits installed in exposed areas shall be installed with a box offset before entering box.

Conduit Installation
Cut conduit square; de-burr cut ends.

Conduit shall not be fastened to the corrugated metal roof deck.

Bring conduit to the shoulder of fittings and couplings and fasten securely.

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.

All conduit terminations (except for terminations into conduit bodies) shall use 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.

Install no more than the equivalent of three 90 degree bends between boxes.

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.

Conduit shall be bent according to manufacturers recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.

Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.

Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.

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.

Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.

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.

Route conduit through roof openings for piping and ductwork where possible.

Conduit is not permitted in any slab topping of two inches (50 mm) or less.

Ground and bond conduit under provisions of Section 26 05 26.

Maximum Size Conduit in Slabs Above Grade: 3/4 inch (19 mm). Do not route conduits to cross each other in slabs above grade.

PVC conduit shall transition to galvanized rigid metal conduit before it enters a concrete pole base, foundation, wall (where exposed) or up through a concrete floor.

Identify conduit under provisions of Section 26 05 53.

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.

PVC conduit shall be cleaned with solvent, and dried 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 manufacturers recommendations.

Conduit Installation Schedule
Conduit other than that specified below for specific applications shall not be used.

Underground Installations Within Five Feet (1.5 m) of Foundation Wall: Rigid steel conduit.

Underground Installations More than Five Feet (1.5 m) From Foundation Wall: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit.

Under Slab on Grade Installations: Schedule 40 PVC conduit.

Exposed Outdoor Locations: Rigid steel conduit.

Concealed in Concrete and Block Walls: Rigid steel conduit. Electrical metallic tubing. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

Wet Interior Locations: Rigid steel conduit. Schedule 40 PVC conduit.

Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be 1 foot (300 mm), maximum length shall be 3 feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

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 6 foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

Medium Voltage Applications (Interior Locations): Rigid steel conduit.

Nonmetallic Surface Raceway Installation

Use flat headed screws with appropriate anchors to fasten channel to surfaces secured every 24 inches. Mount plumb and level. All surface mounted devices shall be fastened to the wall utilizing flat head screws along with appropriate anchors. No device shall be adhered to the wall surface using two-faced tape or any means other than as described above.

Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

In areas where the walls cannot be fished, the station cable serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, and conference rooms or like facilities.

The non-metallic raceway shall have a screw applied base. Both the base and cover shall be manufactured of rigid PVC materials.

The raceway shall originate from a surface mounted box mounted adjacent to and at the same height as existing electrical boxes in the room, be attached to the wall and terminate above the ceiling.

All fittings including, but not limited to, extension boxes, elbows, tees, fixture bodies shall match the color of the raceway.

The raceway and all systems devices shall be UL listed and exhibit nonflammable self extinguishing characteristics, tested to specifications of UL94V-0.

The raceway and all systems devices shall adhere to the EIA/TIA Category 5e bend radius standard.

Auxiliary Gutters (Wireways) Installation
Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure.

Gasket each joint in oil-tight gutter.

Mount rain-tight gutter in horizontal position only.

Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.

Coordination Of Box Locations
Provide electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

Electrical box locations shown on contract drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.

Boxes shall not be fastened to the metal roof deck.

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.

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.

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.

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.

Locate and install to maintain headroom and to present a neat appearance.

Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

Outlet Box Installation
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.

Power:
Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction 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.

Low Voltage:
Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 11/16 inch square, 2-1/8" deep. 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.

Provide knockout closures for unused openings.

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.

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.

Install boxes in walls without damaging wall insulation.

Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

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.

In inaccessible ceiling areas, position outlets and junction boxes within 6 inches (150 mm) of recessed luminaire, to be accessible through luminaire ceiling opening.

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.

Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

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.

Floor Box Installation
Set boxes level and flush with finish flooring material.

Pull And Junction Box Installation
Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install DOT approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.

Support pull and junction boxes independent of conduit.
END OF SECTION 26 05 53

Section 26 05 53 - Identification for Electrical Systems

PART 1 - GENERAL

Scope
The work under this section includes the products and execution requirements relating to labeling of power, lighting, general wiring, signal, fire alarm, and telecommunications wire and cabling. Further, this section includes labeling of all terminations and related sub-systems, including but not limited to nameplates, stenciling, wire and cable marker labeling of all backbone fiber optic (inter-building, tie and riser) cables, terminating equipment and labeling of inner duct (fiber optic). Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals

PART 2 - PRODUCTS
Materials

PART 3 - EXECUTION
General
Junction and Pullbox Identification
Communication System Identification and Labeling
Communication Backbone, Riser and Tie Cable Labeling
Innerduct Labeling
Communication Conduit Labeling
Power and Control Wire Identification
Nameplate Engraving
Panelboard Directories

Related Work
Applicable provisions of Division 1 shall govern work under this section.

Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
Section 26 05 23 – Control-Voltage Electrical Power Cables
Section 27 00 00 – Communications Cable and Equipment

Submittals
Include schedule for nameplates and stenciling.

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

Materials
Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED. Exception: back side of device plates and junction boxes may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.

Cable label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Labels for power conductors (600V and lower) shall be cloth-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.

Nameplates: Engraved three-layer laminated plastic, black letters on a white background. Emergency system (level 1 and level 2) shall use white letters on red background.

Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.

Adhesive type labels not permitted except for phase and wire identification. Machine generated adhesive labels shall be permitted for device plates, 4-11/16" and smaller junction boxes, Fire alarm and control devices.

PART 3 - EXECUTION

General

Where mixed voltages are used in one building (e.g. 4160 volt, 480 volt, 208 volt) each switch, switchboard, junction box, equipment, etc., on each system must be labeled for voltage in addition to other requirements listed herein.

All branch circuit and power panels must be identified with the same symbol used in circuit directory in main distribution center.

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.

Install nameplates parallel to equipment lines.

Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.

Embossed tape will not be permitted for any application.

Junction And Pullbox Identification

The following junction and pullboxes shall be identified utilizing spray painted covers:

System	Color(s)
Secondary Power – 480Y/277V	Brown
Secondary Power – 208Y/120V, 240/120V	White
Emergency Power – 480Y/277V	Brown/Red
Emergency Power – 208Y/120V	White/Red
Fire Alarm	Red
Temperature Control	Green
Door Control and Door Monitoring System	Orange
Sound and Intercom Systems	Blue
Video Surveillance System/MATV	Yellow

Provide circuit numbers, and source panel designations for power wiring. Other system shall be identified as shown on details or approved shop drawings. Temperature control shall identify the source.

Communications System Identification And Labeling
Backboard and Equipment Racks:
Backboards and equipment racks shall be labeled by the contractor identifying the room number. Additionally, equipment racks shall have an alpha character after the room number unique to that particular communications room. For example, Rack 205A would be the first rack in room 205. Character height shall be 1-inch (minimum).

Station Cable and Termination Components:
Individual labels shall be placed on all Telecommunications Outlets, Data Patch Panels, Voice Termination Blocks, and cables. This is inclusive of each voice, data, video, or fiber optic outlet, or any configuration thereof, as identified on the drawings.

Each component shall be clearly labeled using a code identifying each information outlet location throughout the facility. The project documents identify the numbering at each outlet location. Each media type shall be numbered separately. The format of the identifier shall be as follows:

TR-####X
Where: TR = Telecommunication Room identifier serving that location
= a sequential number assigned to that port starting at 001
X = an alpha character identifying cable type. V=Voice, D=Data

For example: “1A-001D” represents the first data jack served from the Telecommunications Room on the first floor identified as room 1A for that building. A voice outlet at the same location would be labeled as “1A-001V”.

Telecommunication Rooms identifiers shall be unique in each building.

Telecommunications Outlets are to be labeled 1) on the cover of the assembly and 2) on each cable terminated at that location.

All new outlet faceplates shall incorporate recessed label holders and shall be fitted with clear plastic covers. Where no such label holders are present on existing to remain outlets, the faceplate labels shall be protected with a clear over-laminate.

Labels shall be [White] background with [Black] lettering. Lettering size shall be as large as practicable (up to 16-point) to fit properly on the outlet label. No lettering shall be smaller than 12-point.

Copper Data and Fiber Optic Patch Panels shall be labeled identifying Outlet ID. Modular Jacks and/or Fiber Couplers shall be positioned in sequence of Outlet ID. Fiber Panels shall also be labeled with the fiber number. Fibers shall be sequenced in order per the manufacturer's color code.

Each Station Cable shall be labeled within 4-inches of the cable end at the Data Patch Panel, 110 blocks, and Information Outlet.

Communication Backbone, Riser And Tie Cable Labeling
All fiber optic backbone and copper (inter-building, riser and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable terminates (e.g. Equipment Room or Telecommunications Closet I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

Innerduct Labeling
All innerduct containing fiber optic cable installed under this project shall be labeled where exposed. This includes areas where the innerduct is (1) installed alone in risers, tunnels or trays, (2) where they transit manholes and/or pull boxes and (3) in equipment rooms.

The innerduct shall be labeled with a durable Yellow Polyethylene tag which reads "CAUTION FIBER OPTIC CABLE" and includes blank spaces for adding fiber count and destination information. The destination of the cable(s) contained in the innerduct and the fiber count shall be marked on the tag. Hand lettering is acceptable on this tag, using an indelible type ink.

The tag shall be secured to the innerduct(s) using self-locking ties.

Innerduct shall be labeled on each floor in a riser installation, in each manhole and/or handhole or at 25-foot intervals in a tunnel or tray installation.

Communication Conduit Labeling
All conduits installed between Telecommunication Rooms shall be clearly labeled in accordance to ANSI/TIA/EIA-606. Both ends of the conduits shall be labeled. All labels shall be mechanical, no hand written labels. 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).

Power And Control Wire Identification
Provide wire markers 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 control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

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.

Wiring Device Identification
Wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through fittings, access floor boxes, photocells and time clocks shall be identified with circuit numbers and source. In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated labels, or neatly hand-written permanent marker.

Nameplate Engraving
Provide nameplates of minimum letter height as scheduled below.

Panelboards, Switchboards and Motor Control Centers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source.

Equipment Enclosures: 1 inch (25 mm); identify equipment designation.

Circuit Breakers, Switches, and Motor Starters in Panelboards or Switchboards or Motor Control Centers: 1/2 inch (13 mm); identify circuit and load served, including location.

Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, and Motor Starters: ½ inch (13 mm); identify source and load served.

Transformers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify primary and secondary voltages, primary source, and secondary load and location.

Junction boxes: 1 inch (25 mm); identify system source(s) and load(s) served. Junction boxes may be neatly identified using a permanent marker.

Panelboard Directories
Typed directories for panels must be covered with clear plastic, 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 24 13 - Switchboards

PART 1 - GENERAL

Scope
The work under this section includes main and/or distribution switchboard(s) specified herein and shown on the drawings. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Operation and Maintenance Data
- Delivery, Storage, and Handling
- Extra Materials

PART 2 - PRODUCTS
- Switchboard Construction and Ratings
- Overcurrent Protective Devices
- Coordination of Overcurrent Protective Devices
- Instruments and Sensors

PART 3 - EXECUTION
- Installation
- Field Quality Control
- Adjusting

Related Work
Applicable provisions of Division 1 govern work under this section.

References
ANSI C57.13 – Instrument Transformers
NEMA AB 1 - Molded Case Circuit Breakers
NEMA KS 1 - Enclosed Switches.
NEMA PB 2 - Dead Front Distribution Switchboards.
NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
UL-891 - Dead Front Switchboards.

Submittals
Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; one-line diagrams; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics

including voltage, frame size and trip ratings, withstand ratings, and time-current curves and interrupting ratings of all equipment and components.

Submit the manufacturer provided coordination study and the overcurrent device set point recommendations to the consulting engineer for approval.

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. Bus tightening intervals and procedures.
2. Overcurrent protective device testing and maintenance procedures.
3. Coordination study and the overcurrent device set point recommendations.
4. Field report noting final adjustments to overcurrent protective device settings.

Delivery, Storage, And Handling
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.

Handle in accordance to NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

Extra Materials
Submit one set of spare fuses of each size and type used in the equipment provided.

PART 2 - PRODUCTS

Switchboard Construction And Ratings
Switchboard electrical rating and short circuit current rating shall be as shown on the drawings.

Main Section Devices: Individually mounted.

Distribution Section Devices: Group-mounted and/or individually mounted, complete with bus in an integrated assembly. All breakers shall be bolted, quick-make, quick-break, trip indicating and common trip on all multi-pole breakers. No handle ties will be permitted.

Buses:
The switchboard bussing (and all other current carrying parts such as fingers, neutral and ground buses) shall be plated copper. The bussing shall be of sufficient cross-sectional area to meet UL 891 temperature rise requirements.

For 4-wire systems, the neutral bus shall be the equivalent ampacity as the phase bus bars.

Provide a copper ground bus through the length of the switchboard sized per UL 891 and NFPA requirements.

Where spaces are indicated for future breakers, extend bus bars, drill and tap bus, and fully equip for the future breakers, including all connectors and mounting hardware.

Enclosure.
Factory-assembled, dead front, metal-enclosed, and self-supporting switchboard assembly conforming to NEMA PB2, and complete from incoming line terminals to load-side terminations.

All closure plates shall be screw removable and small enough for easy handling by one person.

Finish: Manufacturer's standard medium gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

Enclosure shall be NEMA PB 2 Type [1 - General Purpose.] [3R - Raintight.]

Pull Box: Same construction as switchboard, top and sides shall be removable.

Pull Section: Same construction as switchboard, width, depth and height to match switchboard.

Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials used.

[Provide metering transformer compartment for Utility Company's use. Compartment size, location, bus spacing and drilling, door, and locking and sealing requirements shall meet the requirements of the local utility company.]

Overcurrent Protective Devices
Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip elements in each pole.

Electronic Trip Circuit Breaker: As scheduled on the drawings, electronic circuit breakers shall have, at a minimum, adjustments for long time trip and instantaneous trip. Provide integral ground fault sensing with adjustable ground fault trip where indicated on the drawings.

Coordination Of Overcurrent Protective Devices
The manufacturer shall perform a coordination study of the electrical system and recommend set points for all of the overcurrent and ground fault trip adjustments on the equipment provided. The coordination study and set point recommendations shall be submitted to the consulting engineer for approval.

Instruments And Sensors
Provide an electronic meter (with meter test switch and instrument transformers) for owner's use in the switchboard. Meter and related equipment shall meet the requirements of specification section 26 27 13.

PART 3 - EXECUTION

Installation
Install switchboard in locations shown on drawings, in accordance to manufacturer's written instructions and NEMA PB 2.1.

Install switchboard on a 3.5" high concrete equipment pad.

Tighten accessible bus connections and mechanical fasteners after placing switchboard.

Field Quality Control
Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance to manufacturer's recommended values.

Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.

Touch up scratched or marred surfaces to match original finish.

Adjusting
Adjust all operating mechanisms for free mechanical movement.

Adjust trip and time delay settings to values as recommended in coordination study provided by manufacturer or as instructed by the A/E. Include a copy of the coordination study and recommended circuit breaker set points in the O&M manual.
END OF SECTION 26 24 13

Section 26 24 16 - Panelboards

PART 1 - GENERAL

Scope
The work under this section includes main, distribution and branch circuit panelboards. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals
- Operation and Maintenance Data
- Spare Parts

PART 2 - PRODUCTS
- Main and Distribution Panelboards
- Branch Circuit Panelboards

PART 3 - EXECUTION
- Installation
- Field Quality Control

Related Work
Applicable provisions of Division 1 govern work under this section.

Submittals
Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

Operation And Maintenance Data
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

Spare Parts
Keys: Furnish 2 keys for each panelboard to owner.

PART 2 - PRODUCTS

Main And Distribution Panelboards

Panelboards: Circuit breaker type.

Enclosure: NEMA Type 1. 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.

Provide cabinet front with hinged door with flush lock. 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.

Provide metal directory holders with clear plastic covers.

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.

Minimum System (i.e. individual component) Short Circuit Rating: As shown on the drawings.

Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

Branch Circuit Panelboards

Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.

Enclosure: Type 1. 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.

Provide surface cabinet front 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.

Provide metal directory holders with clear plastic covers.

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.

Minimum System (i.e. individual component) Short Circuit Rating: As shown on the drawings.

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.

Do not use tandem circuit breakers.

Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

All of the panelboards provided under this section shall be by the same manufacturer.

PART 3 - EXECUTION

Installation
See section 26 05 29 for support requirements.

Install panelboards plumb with wall finishes.

Height: 6 feet (2 m) to top.

Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.

Provide filler plates for unused spaces in panelboards.

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.

Stub three empty ¾" conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

Field Quality Control
If aluminum conductors size #1/0 and larger (per Section 26 05 19) are to be used as panelboard feeders, it is the responsibility of the contractor to provide panelboards with adequate wire bending space to accommodate the aluminum conductors and terminators

to meet allowable code requirements. The contractor shall circuit the panelboards as shown on the drawings. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent.

Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.
END OF SECTION 26 24 16

Section 26 27 02 - Equipment Wiring Systems

PART 1 - GENERAL

Scope
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:

- HVAC motors, and panels
- Plumbing motors, and panels

Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals
- Coordination

PART 2 - PRODUCTS
- Cords and Caps
- Other Products

PART 3 - EXECUTION
- Inspection
- Preparation
- Installation
- HVAC and Plumbing Connections
- Equipment Connection Schedule

Related Work
Applicable provisions of Division 1 govern work under this Section.

Section 26 05 33 – Raceway and Boxes for Electrical Systems.
Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.

Submittals
Product Data: Provide data for cord and wiring devices.

Coordination
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

Cords And Caps
Straight-blade Attachment Plug: NEMA WD 1.

Locking-blade Attachment Plug: NEMA WD 5.

Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

Cord Construction: Oil-resistant thermoset insulated multiconductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

Other Products
Refer to related sections for other product requirements.

PART 3 - EXECUTION

Inspection
Verify that equipment is ready for electrical connection, wiring, and energization.

Preparation
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.

Installation
Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.

Make conduit connections to equipment using flexible PVC-coated metal conduit.

Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.

Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.

Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance to manufacturer's instructions. Provide interconnecting wiring where indicated.

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.

Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

Hvac And Plumbing Connections
Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, 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.

Provide 120 volts to each temperature control panel. Coordinate requirements with HVAC/DDC contractors.

Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure switches, switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired by the contractor supplying the devices.

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.

Check for proper rotation of each motor.

Equipment Connection Schedule
As indicated on the drawings.
END OF SECTION 26 27 02

Section 26 27 26 - Wiring Devices

PART 1 - GENERAL

Scope
The work under this section includes wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through service fittings, access floor boxes, photo cells and time clocks. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals

PART 2 - PRODUCTS
- Wall Switches
- Receptacles
- Occupancy Sensors
- Wall Dimmers
- Device Plates and Box Covers
- Poke-Through Fittings
- Photo Cells
- Time Clocks
- Time Switch

PART 3 - EXECUTION
- Installation
- Field Quality Control
- Occupancy Sensors
- Adjusting

Related Work
Applicable provisions of Division 1 govern work under this Section.

Submittals
Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

For occupancy sensor shop drawings, the manufacturer’s actual layout of occupancy sensors and the wiring diagrams shall be provided.

Operation And Maintenance Data
All operations and maintenance data shall comply with the submission and content requirements specified under section General Requirements.

PART 2 - PRODUCTS

Wall Switches

Wall Switches for Lighting Circuits [and Motor Loads Under 1/2 HP]: 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 with separate green ground screw.

All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG. Switches shall be Leviton model 1221-S, Hubbell model CS1221, Pass & Seymour model CSB20, Cooper model CSB120, or approved equal.

Handle: Ivory, made of nylon or high impact resistant material.

Receptacles

Convenience and Straight-blade Receptacles: 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. 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 Leviton model 5362-S, Hubbell model CR5362, Pass & Seymour model CRB5362, Pass & Seymour model PT5362 with 90º connector, Cooper model 5362C, or approved equal.

Generally, all receptacles shall be duplex convenience type unless otherwise noted.

All receptacles installed in outdoor locations, in garages, within 6 feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.

GFCI Receptacles: Duplex convenience receptacle, Specification Grade, with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A and UL standard 498. GFCI receptacles shall be Leviton model 8899, Hubbell model GRF5352, Pass & Seymour model 2095 or approved equal.

All receptacles on emergency circuits shall have a red face.

All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of the receptacle.

Locking-Blade Receptacles: As indicated on drawings.

Specific-use Receptacle Configuration: As indicated on drawings.

Occupancy Sensors

All occupancy sensors shall be hardwired type; battery type shall not be permitted.

Wall Mounted (Wall Switch Type)
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.

Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz

Sensitivity shall be user adjustable or self adjusting type.

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.

The off switch shall have manual override for positive off and automatic on.

The test LED shall indicate motion.

The area of coverage shall be approximately 180 degrees by 35-40 feet.

Ceiling Mounted
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.

Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Provide power pack as required for low voltage sensors.

Sensitivity shall be user adjustable or self adjusting type.

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.

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.

Test LED to indicate motion.

See drawings for actual type of sensor.

Device Plates And Box Covers
Decorative Cover Plate: Ivory smooth thermoplastic nylon. Note requirement for red plates on emergency outlets.

Weatherproof Cover Plate: Gasketed metal with hinged device covers.
Surface Cover Plate: Raised galvanized steel.

Photo Cells
The controller shall be rated 2000 watts tungsten at 120, 240 or 277 volts. The cell shall be cadmium sulfide, 1" diameter.

The enclosure shall be die cast zinc, gasketed for maximum weather proofing.

The enclosure shall include the positioning lug on the top of the enclosure.

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.

Mounting shall be for a 1/2" conduit nipple.

The unit shall have a 5 year warranty.

The contacts shall be SPST normally closed.

The operational temperature range shall be -40 to 140 degrees F(-40 to +60 degrees C).

Time Clocks
Unit shall be a multi-purpose, 7 day, 365 day advance single and skip a day, combination 2 channel electronic time clock with a SPDT switching configuration and astronomic dial.

The contacts shall be rated 10 amp resistive at 120/250 VAC, 7.5 amps inductive at 120/250 VAC, 5 amps inductive at 30 VDC and up to 1/2 hp at 250 VAC. The unit shall be rate for 30 VDC, 120 VAC, 250 VAC and 277 VAC.

The controller shall be capable of programming in the AM/PM or 24 hour format by jumper selection, in one minute resolution, using 2 buttons only for all basic settings.

Display shall be LED type.

The unit shall have 365 day and or holiday selection capabilities, with 16 single date and 5 holiday selection options and user selectable daylight savings/standard time functions.

The unit shall have 72 hour memory backup with rechargeable battery and charger.

The unit shall be capable of manual override, On and OFF to the next scheduled event, using 1 button for each channel.

The enclosure shall be rated for indoor or outdoor installation.

PART 3 - EXECUTION

Installation

Install wall switches 48 inches above floor, OFF position down.

Install convenience receptacles 18 inches above floor, 6 inches above.

Install box for information outlet 18 inches above finished floor. Install box for telephone jack for wall telephone 48 above finished floor.

Install specific-use receptacles at heights shown on contract drawings.

Drill opening for poke-through fitting installation in accordance to manufacturer's instructions.

Install decorative plates on switch, receptacle, and blank outlets in finished areas.

Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

Install devices and wall plates flush and level.

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.

Field Quality Control

Inspect each wiring device for defects.

Operate each wall switch and sensor with circuit energized and verify proper operation.

Verify that each receptacle device is energized.

Test each receptacle device for proper polarity.

Test each GFCI receptacle device for proper operation.

The user agency and DOT personnel reserve the right to be present at all tests.

Occupancy Sensors

Power packs used in return air plenum ceiling areas shall be installed in an approved enclosure or UL listed for return air plenum.

Provide a minimum of 4’ of coiled cable for ceiling-mounted sensors.

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 and office). Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink.

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.

For lights on emergency power without a remote transfer device, route the emergency circuit through a separate relay controlled by the occupancy sensor(s) in the respective area. For lights on emergency power with a remote transfer device, the emergency power does not get routed through the occupancy sensor relay, but the normal power does get routed through the occupancy sensor relay.

Adjusting
Adjust devices and wall plates to be flush and level.

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

Scope
The work under this section includes disconnect switches, fuses and enclosures. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Disconnect Switches
- Fuses

PART 3 - EXECUTION
- Installation

Related Work
Applicable provisions of Division 1 govern work under this Section.

Submittals
Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

Operation And Maintenance Data
All operations and maintenance data shall comply with the submission and content requirements specified under section General Requirements.

PART 2 - PRODUCTS

Disconnect Switches
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 cartridge type fuses.

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.

Enclosure: NEMA Type 1 and 3R.as indicated on drawings.

Provide manufacturer’s equipment ground kit in all disconnect switches.

Fuses
Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class. Interrupting Rating: 200,000 rms amperes.

Provide three spares of each size and type fuse. Provide enclosure for spare fuse.

PART 3 - EXECUTION

Installation
Install disconnect switches where indicated on drawings.

Provide identification as specified in Section 26 05 53.
END OF SECTION 26 27 28

Section 26 27 30 - Contractors

PART 1 - GENERAL

Scope
The work under this section includes general purpose contactors and lighting contactors. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Project Record Documents
- Operation and Maintenance Data
- Regulatory Requirements

PART 2 - PRODUCTS
- General Purpose Contactors
- Lighting Contactors
- Accessories

PART 3 - EXECUTION
- Installation
- Schedule

Related Work
Applicable provisions of Division 1 govern work under this Section.

References
ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
ANSI/NFPA 70 - National Electrical Code.

Submittals
Product Data: Include dimensions, size, voltage ratings, current ratings, enclosure type and NEMA sizes.

Project Record Documents
Accurately record actual locations of each contactor and indicate circuits controlled.

Operation And Maintenance Data
All operations and maintenance data shall comply with the submission and content requirements specified under section General Requirements.

Regulatory Requirements
Furnish products listed and classified by Underwriters Laboratories Inc., or ETL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

General Purpose Contactors
Description: NEMA ICS 2, AC general purpose magnetic contactor.

Coil Voltage: As scheduled.

Poles: As scheduled.

Size: As scheduled.

Enclosure: as scheduled.

Accessories: As scheduled.

Lighting Contactors
Description: NEMA ICS 2, magnetic lighting contactor, 100% rated.

Configuration: Mechanically held.

Coil Voltage: As scheduled.

Poles: As scheduled.

Contact Rating: As scheduled.

Enclosure: ANSI/NEMA ICS 6, as scheduled.

Accessories: As scheduled.

Accessories
Pushbuttons and Selector Switches: NEMA ICS 2, general duty type.

Indicating Lights: NEMA ICS 2, LED push-to-test type.

Auxiliary Contacts: NEMA ICS 2, Class A300.

PART 3 - EXECUTION

Installation
Install in accordance to manufacturer's instructions.

The installation must be accessible. The preferred location shall be in the electrical or the mechanical rooms or as shown on the drawings.
END OF SECTION 26 27 30

Section 26 28 13 - Fuses

PART 1 - GENERAL

Scope
The work under this section includes 250 volt fuses. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals
- Regulatory Requirements
- Extra Materials

PART 2 - PRODUCTS
- 250 Volt Fuses

PART 3 - EXECUTION
- Installation

Related Work
Applicable provisions of Division 1 govern work under this section.

Submittals
Provide device dimensions, nameplate nomenclature, and electrical ratings.

Submit manufacturer’s product data sheets with installation instructions.

Regulatory Requirements
Listed by Underwriter's Laboratories, Inc., and suitable for specific application.

Extra Materials
Provide three spares of each size and type fuse.

PART 2 - PRODUCTS

250 Volt Fuses
Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class Interrupting Rating: 200,000 rms amperes.

Provide enclosure for spare fuses.

PART 3 - EXECUTION

Installation
Fuses shall not be installed until equipment is ready to be energized.

Install spare fuse storage enclosure in Electrical Room.
END OF SECTION 26 28 13

Section 26 28 16 - Enclosed Switches and Circuit Breakers

PART 1 - GENERAL

Scope
The work under this section includes enclosed molded case circuit breakers. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Operation and Maintenance Data
- Regulatory Requirements
- Delivery, Storage, and Handling

PART 2 - PRODUCTS
- Circuit Breakers
- Ratings
- Enclosure
- Accessories

PART 3 - EXECUTION
- Installation
- Adjusting

Related Work
Applicable provisions of Division 1 govern work under this Section.

References
NEMA AB 1 - Molded Case Circuit Breakers.

Submittals
Include circuit breaker ratings, withstand ratings, frame size, time-current and let-through current curves, outline dimensions, and terminal lug sizes.

Operation And Maintenance Data
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

Regulatory Requirements
Circuit breakers listed by Underwriter's Laboratories, Inc., and suitable for specific application.

Delivery, Storage, And Handling
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.

PART 2 - PRODUCTS

Circuit Breakers
Molded Case Circuit Breakers: Inverse time with integral thermal and instantaneous magnetic trip elements in each pole.

Electronic Trip Circuit Breaker: As scheduled on the drawings, electronic circuit breakers shall have, at a minimum, adjustments for long time trip and instantaneous trip. Provide integral ground fault sensing with adjustable ground fault trip where indicated on the drawings.

Ratings:
Ratings as shown on the drawings.

Enclosure
Enclosure: NEMA AB 1; Type 1 and 3R.

Fabricate enclosure from steel.

Finish using manufacturer's standard gray enamel finish.

PART 3 - EXECUTION

Installation
Install enclosed circuit breakers where shown on drawings, in accordance to manufacturer's instructions.

Adjusting
Adjust trip and time delay settings to values as recommended in coordination study provided by manufacturer or as instructed by the Architect/Engineer.

Field Quality Control
Inspect visually and perform several mechanical ON-OFF operations on each circuit breaker.
END OF SECTION 26 28 16

Section 26 29 00 - Low-Voltage Controllers

PART 1 - GENERAL

Scope
The work under this section includes manual motor starters, magnetic motor starters, combination magnetic motor starters and motor control centers. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Coordination With Other Trades
- References
- Submittals
- Operation and Maintenance Data
- Delivery, Storage, and Handling
- Spare Parts

PART 2 - PRODUCTS
- Manual Motor Starters
- Magnetic Motor Starters
- Controller Overcurrent Protection and Disconnecting Means
- Motor Control Center
- Fuses

PART 3 - EXECUTION
- Installation

Related Work
Applicable provisions of Division 1 shall govern work under this Section.

Section 26 05 29 – Hangers and Supports for Electrical Systems.

Coordination With Other Trades
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.

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:

1. Motors 1/3 HP and smaller shall be wound for operation on single phase, 60 Hz. service unless otherwise noted.
2. Motors 1/2 HP and above shall be wound for operation on 3 phase, 60 Hz service unless otherwise noted.
3. Refer to drawings in each case in order to verify voltage characteristics required.

Equipment:
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.

The starters for these motors shall be furnished and installed by the Electrical Trade unless noted otherwise. (See Motor Schedule on drawings.)

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.

Wiring Connections:
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.

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.

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.

Power Branch Circuits:
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.

References

ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
ANSI/UL 198E - Class R Fuses.
NEMA AB 1 - Molded Case Circuit Breakers.
NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
NEMA KS 1 - Enclosed Switches.
NEMA PB 1 - Panelboards.
NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

Submittals

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.

Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

Operation And Maintenance Data

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

Delivery, Storage, And Handling

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.

Handle in accordance to manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

Spare Parts

Keys: Furnish two each to owner.

Provide three spares of each size and type fuse used. Provide enclosure for spare fuses.

Fuse Pullers: Furnish one fuse puller to Owner.

PART 2 - PRODUCTS

Magnetic Motor Starters

Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower; size 0 minimum.

Full Voltage Starting: Non-reversing type.

Coil Operating Voltage: 120 volts, 60 Hz.

Overload Protection: bimetal or melting alloy.

Enclosure: NEMA Type: As indicated on the drawings.

Provide manufacturer's equipment ground kit in all starter enclosures.

Auxiliary Contacts: NEMA ICS 2; two and normally open, field convertible contacts in addition to seal-in contact.

Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.

Indicating Lights: NEMA ICS 2; LED Push-to-test type. RUN: red in front cover.

Relays: NEMA ICS 2; Provide on-time delay (0-60 sec) relays as indicated on the drawings.

Provide phase loss protection relay with each motor starter, with contacts to de-energize each motor starter.

Control Power Transformers: Each magnetic starter shall have a fused primary and a fused 120Vsecondary control transformer, sized for the load, 100 VA minimum. Additionally, the X2 terminal of the control transformer shall be grounded.

Combination Motor Starters: Combine motor starters with disconnect in common enclosure.

Fuses

Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class. Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

Installation
Install motor control equipment in accordance to manufacturer's instructions.

Motor Starter Panelboard Installation: In conformance with NEMA PB 1.1.

Select and install heater elements in motor starters to match installed motor characteristics.

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

Scope
The work under this section includes providing a complete factory assembled packaged engine generator system with controls and startup testing. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Permits
- Submittals
- Operation and Maintenance Data
- Quality Assurance
- Extra Materials

PART 2 - PRODUCTS
- System Ratings
- Engine and Engine Equipment
- Generator
- Accessories

PART 3 - EXECUTION

Examination
Installation
Field Quality Control
Demonstration

Related Work

Applicable provisions of Division 1 govern work under this section.

Section 26 36 00 - Transfer Switches.

References

NFPA110 – Emergency and Standby Power Systems.
ANSI/NEMA MG 1 - Motors and Generators.

Permits

The contractor shall be responsible for obtaining all necessary permits for the complete installation of the generator fuel system and related equipment. The contractor shall arrange to have a certified tank installer supervise and certify the fuel system installation.

Submittals

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.

Submit manufacturer's installation instructions.

Operation And Maintenance Data

The O&M manuals shall contain at least the following:

- Instructions for operating equipment.
- Identification of operating limits which may result in hazardous or unsafe conditions.
- Document ratings of equipment and each major component.
- Routine preventive maintenance and lubrication schedule.
- List of special tools, maintenance materials, and replacement parts.
- Technical data sheets.
- Wiring diagrams.

Quality Assurance

Manufacturer: Company specializing in packaged engine generator systems with minimum ten years documented experience.

Supplier: Authorized distributor of engine generator manufacturer with service facilities within 100 miles of project site.

Extra Material
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

System Ratings
Generator Set Rating: 80 kW, 100 kVA, .8pf, 208/120, VAC, 3 phase, 4 wire, 12 wire re-connectable, 60 Hz at 1,800 rpm. Standby power rated.

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.

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.

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.

Voltage regulation shall be ±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 ±1.0% of rated voltage.

Frequency regulation shall be ±0.5% from steady state no load to steady state rated load.

Harmonic distortion shall not exceed 5% total harmonic distortion at full linear load and no single harmonic shall exceed 3% of rated voltage.

Telephone Influence Factor: TIF shall be less than 50.

Engine And Engine Equipment
Engine Type: Water-cooled, turbo-charged, four cycle, internal combustion engine.

Fuel Type:LP Gas

Engine Speed: 1,800 rpm.

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.

Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

Include remote starting control circuit, with RUN-OFF-AUTO selector switch on engine generator control panel.

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.

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 as shown on the drawings.

Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

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 (43 degrees C). Radiator shall be provided with a duct adapter flange permitting the attachment of air discharge duct directing the discharge of radiator air through the wall. The equipment supplier shall provide 50% ethylene glycol antifreeze solution to fill engine cooling system.

Exhaust System: Provide critical grade silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance to engine manufacturer's instructions. Contractor shall mount muffler so its weight is not supported by the engine.

Flexible exhaust connections shall be provided as required for connection between engine exhaust manifold and exhaust line, in compliance with applicable codes and regulations.

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.

Provide a suitable rain cap at the stack outlet. Provide all necessary flanges and special fittings for proper installation.

Contractor shall mount and install all exhaust components as shown on drawings and 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.

Fuel System: Provide LP gas tank , UL listed; State of Wisconsin approved; fuel gauge; low fuel. The fuel tank shall be pressure tested for a minimum of 2 hours to ensure its integrity.

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.

Batteries: 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.

Generator
Insulation: ANSI/NEMA MG 1, Class H.

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.

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.

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.

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.

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.

Provide a mainline molded case circuit breaker 250 amp, 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.

Accessories
Provide the following accessories with the engine generator set:

Enclosure: Weather protective housing with the following features:

- Galvanized steel body.
- Lifting points on base frame.
- Stainless steel flush fitting latches and hinges.
- Zinc plated or stainless steel fasteners.
- Sheet steel components pre-treated with zinc phosphate prior to polyester powder coating.
- Lockable wide door on each side installed to allow 180 degree opening rotation.
- Radiator fill access door with lockable cover.
- Lube oil and coolant drains piped to the exterior of the enclosure skid base.
- Battery can only be reached through lockable doors.
- Sound attenuation housing to limit noise level not to exceed 70dB at 7 meters

Battery Heater: Thermostatically controlled battery blanket heater, 120VAC.

Battery Tray: Plastic coated metal tray treated for electrolyte resistance, constructed to contain spillage of electrolyte.

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:

- Loss of AC power-red light (no relay contact).
- Low battery voltage-red light.
- High battery voltage-red light (no relay contact).
- Charger fail-red light.

Engine-Generator Digital Control Panel: Top of control panel shall not be more than 6 feet above finished floor (this may require remote mounting). NFPA - 110 and NFPA - 99, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include the following features:

- Power source with circuit protection: 12or 24 VDC.
- Operating temperature range: –40degree C to +70 degree C.
- Humidity range: 5% to 95% non-condensing.
- Remote annunciator panel.
- Alarm horn.
- Indicators: not on auto, program, systems, warning.
- Alphanumeric digital display.
- Keypad with multi-function soft membrane environmentally sealed cover.
- Frequency Meter.
- True RMS AC Voltage.
- AC Output Amperage.
- Front mounted output voltage adjustment, locking screw driver type, to adjust voltage ±5% from rated value.
- Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
- Push-to-test indicator lamps, one each for high engine temperature and low engine oil pressure pre-alarm and one run light.
- A flashing red light to indicate the generator set is not in automatic start mode.
- Engine run/off/auto selector switch.
- Emergency stop “mushroom” switch.
- Engine running time meter.
- Oil pressure gauge.
- Water temperature gauge.
- Battery voltmeter.

Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.

Remote Alarm Contacts: Pre-wire form C contacts to terminal strip for remote alarm functions required by ANSI/NFPA 110.

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.

The NEMA 1 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.

PART 3 - EXECUTION

Examination
Verify that required utilities are available in proper location and ready for use.

Installation
Install in accordance to manufacturer's instructions.

Generator set shall be anchored to the floor or concrete pad.

Contractor shall provide all required fuel during testing and a full tank of fuel at the time of Substantial Completion of the project.

Field Quality Control
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.

Demonstration
Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency power.
END OF SECTION 26 32 00

Section 26 36 00 - Transfer Switches

PART 1 - GENERAL

Scope
The work under this section includes transfer switches (less than 600V) for standby generator systems. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Quality Assurance
- Submittals
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Automatic Transfer Switch
- Ratings
- Automatic Sequence of Operation
- Accessories
- Elevator Control Interface Accessories

PART 3 - EXECUTION
- Installation
- Field Adjustments
- Construction Verification Items
- Agency Training

Related Work
Applicable provisions of Division 1 govern work under this section.

Section 26 32 00 - Packaged Generator Assemblies.

Quality Assurance
Manufacturer: Company specializing in automatic transfer equipment with five years documented experience.

Submittals
Submit product data showing overall dimensions, electrical connections, electrical ratings, all specified accessories, interlock methods, and environmental requirements.

Submit 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:

Instructions for operating equipment under test and emergency conditions.

PART 2 - PRODUCTS

Automatic Transfer Switch

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.

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.

The switch shall be rated for continuous duty and be mechanically interlocked to be in either the normal or the emergency position.

The switch shall be controlled by electronic solid state components with printed circuit control boards, and industrial grade plug in control relays.

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.

Ratings

Ratings: As scheduled on drawings.

Automatic Sequence Of Operation

Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.

Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

Time Delay Before Transfer to Alternate Power Source: 0 to 60 seconds, adjustable.

Initiate Re-transfer Load to Normal Source: Upon permission by normal source monitor.

Time Delay Before Transfer to Normal Power: 0 to 30 minutes adjustable.

Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, unloaded operation.

Operating transfer time of the switch in either direction shall not be greater than 1/6 of a second.

Engine Exerciser: Digital control, - start engine every 7 to 30 days adjustable; run for 0 to 120 minutes adjustable, before shutting down. Bypass exerciser control if normal source fails during exercising period.]

Accessories
Manual Operator: Provide manual operator to allow switch to be operated under no-load conditions from behind a barriered partition or with the door closed.

Indicating Lights: LED type. Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.

Test Switch: Mount in cover of enclosure to simulate failure of normal source by interrupting the power signal to the normal source monitor.

Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.

Transfer Switch Auxiliary Contacts: Minimum 2 normally open; 2 normally closed.

Normal Source Monitor: Monitor each line of normal source voltage; adjustable set points; initiate transfer when voltage drops below 85 percent.

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.

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.

A factory installed equipment ground bar shall be provided in each switch enclosure.

Four-pole transfer switches shall contain an overlapping neutral contact or a fully rated switched neutral pole.

Three-pole transfer switches shall contain a factory installed fully rated solid neutral lug assembly.

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

Installation
Install in accordance to manufacturer's instructions.

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 includes contacts as part of the fire pump controller. This control wiring is not shown on the plans but is required to be provided by the electrical contractor.

Field Adjustments
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.
END OF SECTION 26 36 00

Section 26 43 13 - Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits

PART 1 - GENERAL

Scope
The work under this section includes transient voltage surge suppressors (TVSS) as indicated on the project drawings and electrical diagrams. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Submittals
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Transient Voltage Surge Suppressors (Below 600V)
- Surge Suppressor Devices for Critical Branch Panelboards (2nd Tier Locations)

PART 3 - EXECUTION
- Installation
- Construction Verification Items
- Agency Training

Related Work
Applicable provisions of Division 1 govern work under this Section.

Reference Standards

NEMA LS-1 Standard on Low-Voltage Surge Protection Devices.
IEEE C62.62 Standard Test Specification for Surge Protective Devices For Low-Voltage AC Power Circuits.
IEEE C62.41 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
UL1449, Second Addition – Standard For Safety For Transient Voltage Surge Suppressors.

Quality Assurance

The manufacturer shall have been in the TVSS industry for a minimum of 5 years.

Submittals

Include all TVSS data necessary to show device is in compliance with all product specifications. Include product data sheets which show the device dimensions, weight, connections, and mounting requirements, along with installation instructions.

Operation And Maintenance Data

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

TRANSIENT VOLTAGE SURGE SUPPRESSORS (Below 600V)

The transient voltage surge suppressor (TVSS) shall be suitable for use on service entrances (ANSI/IEEE Standard C62, Category C environments). The TVSS shall be connected in parallel with the facility's electrical system.

The TVSS shall be listed in accordance to UL 1449, Second Addition.

The TVSS shall be made up of metal oxide varistors (MOV's), selenium cells, silicon avalanche diodes, or a combination thereof, ensuring that all of the performance requirements are met. Gas tubes shall not be used. The entire unit shall be enclosed in a metal or ABS enclosure, NEMA rated for the location. The TVSS device shall be a unit separate from the switchboard or panelboard (not integral to, or installed within the switchboard or panelboard).

The TVSS shall have a maximum continuous operating voltage (MCOV) rating not less than 115% of nominal voltage of the system it is protecting.

The TVSS shall have no less than line to neutral (L-N), line to ground (L-G), and neutral to ground (N-G) protection modes for 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.

The TVSS shall have a suppressed voltage rating (SVR) as assigned by UL1449, Second Addition which shall not exceed the following:

400 for L-N, L-G, N-G modes in 120/208V wye system.

The TVSS shall have a single-pulse (8 X 20 microsecond waveform as specified in ANSI/IEEE Standard C62) surge current capability of 100 kA (minimum) for each of the L-N, L-G and N-G modes in wye systems, and for each of the L-L and L-G modes for delta systems. Per phase rating not accepted.

Each TVSS shall include externally-mounted LED visual status indicators that indicate the on-line status of the unit, for each phase.

PART 3 - EXECUTION

Installation
Install TVSS devices in accordance to manufacturer's written instructions, applicable requirements of NEC and NEMA standards, and recognized industry practices.

TVSS devices 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 neutral bus bar, keeping lead length to a minimum. TVSS devices shall be connected through a multi-pole circuit breaker (30A maximum), not into main lugs. Where circuit breakers are unavailable, a fused disconnect switch should be used to connect to the leads and facilitate servicing of the device. Use schedule 40 PVC conduit between the TVSS device and the switchboard or panelboard. To connect the TVSS device to the circuit breaker or disconnect switch, use #10 conductors or the manufacturer’s recommended conductor size (whichever is larger). Avoid sharp bends, excess length, and splices in the wires. (Where possible, use a close-nippled connection with wires going directly to the breaker of the switchboard or panelboard).

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

Scope
The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Definitions
- Submittals
- Operation and Maintenance Data
- Extra Material

PART 2 - PRODUCTS
- Interior Luminaires and Accessories
- Lamps
- LED Luminaires
- Fluorescent Ballasts
- Compact Fluorescent Ballasts (Electronic)

PART 3 - EXECUTION
- Installation
- Adjusting and Cleaning
- Interface with Other Products
- Field Quality Control
- All Fixture Connections Including Master-Slave
- Construction Verification Items
- Agency Training

Related Work
Applicable provisions of Division 1 govern work under this Section.

- Section 26 08 00 - Commissioning of Electrical
- Section 26 27 26 - Wiring Devices
- Section 01 91 01 or 01 91 02 - Commissioning Process

Reference Standards
RoHS - Restriction of Hazardous Substances. Council of the European Union (EC) Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
LM-79-08 (or latest) - IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.
LM-80-08 (or latest) - IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
TM-21-11 (or latest) - IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.
NEMA SSL 1-2010 (or latest) - Electronic Drivers for LED Devices, Arrays, or Systems.

Definitions
Driver - the power supply used to power LED fixtures, modules, or arrays.

L70, $L_{70,}$ or $L_{70\%}$ - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.

LED's - Broadly defined as complete light fixture with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.

LED luminaire failure - Negligible light output from more than 10 percent of the LED's constitutes luminaire failure.

Submittals
Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance data for each luminaire type.

For each luminaire type, submit luminaire information including catalog cuts with highlighted catalog numbers and required accessories:

- Luminaire:
  - Manufacturer and catalog number.
  - Type (identification) as indicated on the plans and schedule.
- Ballast:
  - Manufacturer and catalog number.
  - Type (Programmed Start, etc.), Ballast Factor, THD, etc.
  - Quantity per fixture.
- Lamps:
  - Manufacturer, catalog number, and wattage
  - Quantity per fixture

Operation And Maintenance Data
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

Extra Material
Provide 3 percent of each lamp type, but not less than one of each type.

Provide one of each type of LED module, light bar, or array (if applicable). If the LED's are integrated into the fixture and are not separate components, then extra LED's are not required.

Provide one ballast of each type. This includes LED drivers.

PART 2 - PRODUCTS

Interior Luminaires And Accessories

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.

Luminaire shall be certified by a Nationally Recognized Testing Laboratory (UL, ETL, or IEC).

Provide lighting fixtures with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

Lamps

General Use Incandescent Lamps and Incandescent Reflector Lamps are prohibited. Use LED or compact fluorescent retrofit lamps in lieu of incandescent or halogen for specialty fixtures. LED retrofit lamps shall be:

- Rated for the voltage of the incandescent lamp they are replacing.
- Dimmable where required as indicated on the plans.
- Rated for the fixture in which they are being installed. Verify whether the fixture is enclosed and whether the retrofit lamp is rated for enclosed fixtures and the temperatures that will be encountered.
- Lamps shall provide delivered footcandles equal to or greater than the footcandles provided by an equivalent incandescent lamp.
- Lamps shall have an average rated life of 25,000 hours, minimum.
- Lamp color temperature shall be nearly equal to the incandescent lamp it is replacing.

Four Foot Fluorescent Lamps: High Performance T8 Lamps:

- Minimum 3000 initial lumens and minimum of 2820 mean lumens.
- Minimum 30,000 hour rated life at three-hour starts using programmed-start ballasts.
- Color Rendering Index (CRI) of 80 or higher.
- 5000ºK color temperature.
- Lamps shall be suitable for use with instant start ballasts and occupancy sensors.
- Lamps shall meet Toxicity Characteristic Leaching Procedure (TCLP) requirements for low mercury as defined by the EPA.
- Mean system efficacy equal to 88 MLPW minimum using programmed-start ballasts.

Acceptable lamp manufacturers and catalog numbers are (or equal):

- GE - F32T8/XL/SPX50/HL/ECO
- OSRAM/SYLVANIA - F032/850/XPS/ECO3
- PHILIPS - F32T8/ADV85/ALTO

Standard Products - F32t8/850/Xl31
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.

Compact Fluorescent Lamps:
Compact fluorescent lamp temperature shall be 5000ºK with a color rendering index (CRI) at or above 80. See lighting fixture schedule on drawings.

All lamps shall be new.

Led Luminaires
LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:

- Minimum Light Output.
- Zonal Lumen Requirements.
- Minimum Luminaire Efficacy.
- Minimum CRI.
- L70 Lumen Maintenance.
- Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

Additional requirements:

- Color Temperature of 3000K-5000K for interior fixtures as listed in the Light Fixture Schedule on the plans. The color temperature of exterior LED fixtures should not exceed 4100K (nominal).
- Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent fixture-to-fixture color for interior fixtures. Exterior fixtures shall use a maximum 5-step MacAdam Ellipse binning process.
- Glare Control: Exterior fixtures shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior fixtures.
- Luminaire shall be mercury-free, lead-free, and RoHS compliant.

- Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
- Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
- Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
- Driver shall have a rated life of 50,000 hours, minimum.
- Lumen output shall not depreciate more than 20% after 10,000 hours of use.
- Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
- Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior fixtures, and a minimum of 70 for exterior fixtures.
- LED fixture shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the fixture is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
- LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
- Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
- Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
- Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
- All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
- Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
- All luminaires shall be provided with knockouts for conduit connections.
- The LED lighting fixture shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
- Provide all of the following data on submittals:
    - Delivered lumens
    - Input watts
    - Efficacy
    - Color rendering index.

Fluorescent Ballasts

All fluorescent ballasts shall be electronic type and shall meet the following specs:

- UL Listed (Class P) sound rating A and CSA certified.
- Comply with EMI and RFI limits set by the FCC (CFR 47 part 18) or NEMA and not interfere with normal electrical equipment.
- Meet any applicable standards set forth by ANSI.
- Be potted or conformal coated in a metallic case and not contain PCBs.
- Provide normal rated lamp life as stated by lamp manufacturers (i.e. rated life at 3 hour burn time per start).
- Provide independent test results from an approved testing laboratory for all of the specifications below. This is required for all submitted ballasts.
- Nominal power factor of .90 or higher.
- Total harmonic distortion of less than 10% at 120 or 277 volts (universal voltage).
- Ballast factor 0.70 through 1.2, as shown on the lighting fixture schedule.
- Frequency of operation shall be 40 kHz - 50 kHz and units shall operate without visible flicker.
- Ballast efficiency factor shall meet Consortium of Energy Efficiency (www.cee1.org) specifications (adopted by Focus on Energy program).
- 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.
- Ballast Efficiency Factor (BEF) shall be as shown in the table below:

Number of Lamps	Low (BF ≤ 0.85)	Normal (0.85 < BF ≤ 1)	High (BF > 1.0)
PROGRAMMED-START BALLASTS (T8 lamps)			
1 2 3 4	≥ 2.84 ≥ 1.48 ≥ 0.97 ≥ 0.76	≥ 2.84 ≥ 1.47 ≥ 1.00 ≥ 0.75	≥ 2.95 ≥ 1.51 ≥ 1.00 ≥ 0.75

- Ballasts shall carry a minimum 5 year warranty with a $10 replacement labor allowance.
- Ballasts shall not be affected by lamp failure.
- Ballasts shall be a standard production item.
- 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.
- Ballasts shall withstand line transients as defined in IEEE 587, Category A.

System Performance:
System performance for programmed-start ballasts shall be as follows:

1. 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

2. 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

Acceptable ballast manufacturer's names and product lines are as follows:
- Osram Sylvania – Quicktronic High Efficiency and Quicktronic PROstart.
- GE Lighting – Ultramax and UltraStart.
- Maxlite – High Efficiency Ballast.
- Advance – Optanium.
- Universal Lighting Technologies – F32T8.
- Approved equal.

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.

Compact Fluorescent Ballasts (Electronic)
- Ballasts shall be high power factor, class P, with voltage rating matching the branch circuit voltage.
- Ballast factor shall be 0.85 or higher.
- Ballast shall have lamp fault shut-off circuitry to prevent starting of a faulty lamp.
- Cold-weather ballast must reliably start and operate the lamp in ambient temperatures down to 0ºF for the rated life of the lamp.

PART 3 - EXECUTION

Installation

Verify ceiling types with Architectural plans or with existing ceilings. Verify specified fixtures are compatible with specified ceiling type(s) prior to ordering fixtures.

Install in accordance to manufacturer’s instructions.

Install suspended luminaires using aircraft cable, or pendants supported from swivel hangers. Heavy duty chain supports may be used where indicated on the fixture schedule. Provide aircraft cable, pendants, or chain lengths required to suspend luminaire at indicated height. All aircraft cables or pendant supported luminaires shall have an independent support to structure at all cable or pendant support locations. When chain is used, tie-wrap the fixture whip to the chain.

Support luminaires larger than 2 x 4 foot (600 x 1 200 mm) size independent of ceiling framing.

Provide independent support for all fixtures over 50 lbs.

Locate ceiling luminaires as indicated on reflected ceiling plan.

Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

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.

Install recessed luminaires to permit removal from below.

Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

Install code required hardware to secure recessed grid-supported luminaires in place.

Install wall mounted luminaires and exit signs at height as scheduled. Use pendants supported from swivel hangers in exposed ceiling/structure locations where necessary to mount exit signs at the specified height.

Install accessories furnished with each luminaire.

Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

Bond fixtures and metal accessories to branch circuit equipment grounding conductor.

Install specified lamps in each luminaire and exit sign.

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.

All new lamps shall be operational at the Substantial Completion of the project.

Adjusting And Cleaning
Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

Aim and adjust luminaires as indicated on drawings or as directed by the A/E.

Touch up luminaire finish at completion of work.

Interface With Other Products
Interface with air handling accessories furnished and installed under Division 23.

Provide controls as indicated on the plans. Refer to section 26 27 26 - Wiring Devices. Controls shall be compatible with the fixtures/ballasts/drivers being installed.

Field Quality Control
Operate each luminaire after installation and connection. Inspect for proper connection and operation.

All Fixture Connections Including Master-Slave
Direct box or conduit connections for surface and recessed fixtures: Use flexible metal conduit from a J-box for recessed lay-in light fixtures. Flexible metal conduit shall be 3/8" (10 mm) minimum diameter and six foot (1.8 m) maximum length. Flexible whip between master and slave fixtures may be supported off of the ceiling grid wires. Conduit length shall allow movement of the fixture for maintenance purposes. Minimum wire size shall be #18 AWG for single fixture or master-slave fixture.

The flexible connectors shall be steel or die-cast, galvanized, snap-in type with locknut, clamp type with locknut, or snap-in connector including those used on the master-slave unit.

Agency Training
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 78 23.
END OF SECTION 26 51 13

Section 26 56 29 - Site Lighting

PART 1 - GENERAL

Scope
The work under this section includes exterior luminaires and accessories, poles, and foundations. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- System Description
- Submittals
- Project Record Documents
- Operation and Maintenance Data
- Coordination
- Extra Material

PART 2 - PRODUCTS
- Luminaries
- HID Ballasts
- Lamps
- Fuses
- Poles
- Pole Foundations

PART 3 - EXECUTION
- Installation
- Field Quality Control
- Adjusting
- Cleaning

Related Work
Applicable provisions of Division 1 govern work under this Section.

References
COMM 53.28 - Pole foundations

System Description
Sidewalk lighting: See electrical plans.

Parking area lighting: See electrical plans.

Submittals
Shop Drawings: Indicate dimensions and components for each luminaire, pole and base.

Product Data: Provide dimensions, ratings, performance data, lamp and ballast data, weights and accessory information for each type.

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, installation, and starting of product.

Light Layout: Provide a computer generated factory point to point foot-candle layout of the project for each area involved.

Design Data: Include lighting calculations.

Post Installation Report: Provide to the engineer and DOT the results of the measured foot-candle level for each area involved. Use a measuring device pre-approved by DOT.

Project Record Documents
Accurately record actual locations of each luminaire, pole and underground circuit.

Provide record drawings of the final, as installed and measured, point to point foot-candle layout for each area involved.

Operation And Maintenance Data
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

Coordination
Use bolt templates and pole mounting accessories to install anchor bolts in pole base.

Extra Material
Provide 3 percent of each fixture type, but not less than 1 fixture of each type.

Provide 10 percent of each lamp type, but not less than 1 of each type.

Provide 5 percent of total fuses provided for each size, but not less than 1 of each size.

Provide 3 percent of each ballast type, but not less than 1 ballast of each type.

PART 2 - PRODUCTS

Luminaires
Furnish products as specified in schedule on drawings.

Hid Ballasts
Physical Requirements:

- Core and coil shall be vacuum impregnated with silica-filled polyester resin.
- Core and coil shall use pre-insulated individual input voltage leads; floating lead and tab terminals are not acceptable.
- Oil-filled capacitors shall be housed in corrosion-resistant steel or aluminum cans and contain ¼" quick disconnect terminals.
- Dry capacitors shall be housed in a flame-retardant thermoplastic case with lead wire terminations and have no exposed live parts.
- Igniters shall be polyester filled with either a plastic or aluminum external housing.
- HID ballast kits with igniters shall have the igniters pre-wired to the core and coil, and have push-in connectors installed on the core and coil "cap" leads.

Lighting Performance Requirements:

- Ballasts shall be designed to provide reliable lamp starting down to –40 degrees C for High Pressure Sodium, -30 degrees C for probe-start Metal Halide, and -30 degreeC/-40 degree C for pulse-start Metal Halide lamps (depending on lamp specifications).

Electrical Performance Requirements:

- Capacitors shall be 100 degree C dry type where rated voltage is $\leq$ 400, and contain bleeder resistors where required by UL. All oil filled capacitors shall contain an internal protective device.
- Igniter shall be designed to operate an average of 10,000 hours at a case temperature of 75 degree C.
- Igniter shall be 105 degree C rated.

Regulatory Requirements:

- Ballast shall be designed and manufactured in accordance to the ANSI Standard for HID Ballasts, ANSI C82.4.
- Ballast shall be UL recognized in accordance to UL 1029 Standard for HID Ballasts or CSA certified in accordance to CAN/CSA-22.2 No. 74-92.

Lamps
Provide lamp type specified for luminaire.

Metal Halide HID Lamps: See schedule.

High Pressure Sodium HID Lamps: See schedule. Suitable for all burning positions.

All lamps shall be new and by the same manufacturer.

Fuses
Furnish and install a fuse holder and fuse in each ungrounded leg of the electrical circuit supplying the outdoor luminaire. Every luminaire shall be separately fused with a waterproof fuse holder. Size the fuse for the amperage of the luminaire. Tap the circuit conductors with a minimum #10 AWG conductor to serve the luminaire. The fuse and holder shall be accessible through the handhole. Provide sufficient wire to bring fuse holder outside of handhole.

Poles
Furnish products as specified in schedule on drawings.

Handhole: With removable weatherproof cover.

Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole.

Pole Foundations
Construct from reinforced concrete in sizes as shown on drawings and to meet the minimum structural requirements of COMM.53.28 - Pole foundations.

Provide 3/4" X 10'0" ground rods in the pole foundation so that the ground rod projects 3" up into center of pole base.

The exposed surface area of the foundation shall have the forms removed and the concrete rubbed out to a smooth finish.

PART 3 - EXECUTION

Installation
Install in accordance to manufacturers' instructions.

Minimum underground conduit size is 1 inch.

Underground and exterior wire shall be type XHHW-2 or USE.

Project anchor bolts 2 inches (50 mm) minimum above base.

Install all anchor bolts and handhole fasteners with anti-seize compound.

Install poles plumb. Provide shims or double nuts to adjust plumb.

Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

Bond each luminaire, each metal accessory, the ground rod and the pole to the branch circuit equipment ground conductor with a separate ground wire sized per NEC or as shown on the drawings.

Field Quality Control
Operate each luminaire after installation and connection. Inspect for improper connections and operation.

Adjusting
Aim and adjust luminaires as indicated on drawings or as directed by the A/E.

All new lamps shall be operational at the Substantial Completion of the project.

Cleaning
Clean photometric control surfaces.

Clean finishes and touch up damage.

END OF SECTION 26 56 29

Section 26 72 60 - Public Address (P.A.) Equipment

PART 1 - GENERAL

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

Summary
This section includes equipment for amplifying, distributing, and reproducing sound signals.

Definitions
Channel: Separate signal path, from source to loudspeaker.

VU: Volume unit.

Performance Requirements

System Functions: Include the following:

- Communicating simultaneously to all zones regardless of zone or channel switch settings.
- Paging, from microphone.
- Reproducing high-quality sound that is free from noise and distortion at the loud-speaker.

Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.

Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components.

Calculations: For sizing backup battery.

Product Certificates: Signed by manufacturers of equipment certifying that products furnished comply with specified requirements.

Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

Manufacturer Certificates: Signed by manufacturers certifying that they comply with requirements.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

Maintenance Data: For equipment to include in maintenance manuals specified in Division 1.

Quality Assurance

Installer Qualifications: An experienced installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

Comply with NFPA 70.

Comply with UL 50.

Occupancy Adjustments
On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions. Provide up to three on-site assistance visits within one year of Substantial Completion.

PART 2 - PRODUCTS

Manufacturers
Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- Alpha Communications.
- Altec Lansing/University Sound.
- Atlas-Soundolier; Atapco Security and Communications Group.
- Bogen Communications, Inc.
- Dukane Corp.; Communications Systems Div.
- Electro-Voice, Inc.
- Executone Information Systems Inc.
- Federal Signal Corp.; Signal Div./Electrical Products.
- Peavey Electronics Corp.
- Rauland-Borg Corp.
- Whelen Engineering Co., Inc.
- Approved equal.

Equipment
Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

Equipment: Modular type, using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

Waterproof Equipment: Listed and labeled for duty outdoors or in damp locations.

Power Amplifiers
Comply with EIA SE-101-A.

Mounting: Counter top

Output Power: 70-W balanced line.

Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.

Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.

Output Regulation: Less than 2 dB from full to no load.

Controls: On/off, input levels, and low-cut filter.

Input Sensitivity: Matched to preamplifier and providing full-rated output with a sound-pressure level of less than 10 dynes/sq. cm impinging on a speaker microphone or handset transmitter.

Components

Microphone: Comply with EIA SE-105.

- Type: Dynamic, with cardioid polar or omnidirectional characteristic.
- Impedance: 150 ohms.
- Frequency Response: Uniform, 60 to 12,000 Hz.
- Output Level: Minus 58 dB minimum.
- Finish: Satin chrome.
- Mounting: Desk stand with integral-locking, press-to-talk switch.

Horn-Type Loudspeakers: Comply with EIA SE-103.

- Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
- Matching Transformer: Comply with EIA-160. Full-power rated with four EIA standard taps. Maximum insertion loss of 0.5 dB.
- Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
- Dispersion Angle: 130 by 110 degrees.
- Mounting: Integral bracket.
- Units in Hazardous (Classified) Locations: Listed and labeled for the environment in which they are located.

Cable and Conductors: Jacketed, twisted-pair and twisted-multipair, untinned, solid-copper conductors.

- Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
- Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick over shield with filled interstices. Shield No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
- Plenum Cable: Listed and labeled for plenum installation.

PART 3 - EXECUTION

Installation

Install equipment to comply with manufacturer's written instructions.

Wiring Method: Install wiring in raceway except within consoles, desks, and counters. Conceal cable and raceway except in unfinished spaces.

Wiring Method: Install wiring in raceway except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces, including plenum ceilings. Conceal cable and raceway except in unfinished spaces.

Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables to identify media in coordination with system wiring diagrams.

Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

Weatherproof Equipment: Install units that are mounted outdoors, in damp locations, or where exposed to weather consistent with requirements of weatherproof rating.

Grounding

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

Install grounding electrodes as specified in Division 16 Section "Grounding."

Field Quality Control

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installations, including connections. Report results in writing.

Operational Test: Perform tests that include originating program and page material at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and freedom from noise and distortion.

Signal-to-Noise Ratio Test: Measure the ratio of signal to noise of complete system at normal gain settings, using the following procedure:

- Disconnect a microphone at the connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other micro-phones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure the ratio of signal to noise.
- Repeat test for each separately controlled zone of loudspeakers.
- Minimum acceptance ratio is 50 dB.

Signal Ground Test: Measure and report ground resistance at pubic address equipment signal ground. Comply with testing requirements specified in Division 16 Section "Grounding."

Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare written record tests.

Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

Schedule tests with at least seven days' advance notice of test performance.

Demonstration
Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain equipment as specified below:

- Train Owners maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment.
- Review data in maintenance manuals. Refer to Division 1 Section "Operating and Maintenance Data/Owner Training."
- Schedule training with owner, through Supervising Professional, with at least seven days' advance notice.

END OF SECTION 26 72 60

END OF DIVISION 26 – ELECTRICAL

Division 27 – Communications

Section 27 00 00 – Communications Cable and Equipment

PART 1 – GENERAL

SCOPE
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 or remodeled] [building and location]. Inter-building, Vertical (Backbone), and Horizontal (Station) cabling comprised of Copper, Fiber Optic, and Coaxial Cabling are covered under this document. Included are the following topics:

PART 1 - GENERAL
Scope
Related Work
Regulatory References
Design Intent
Work Sequence
Submittals
Project Record Documents
Quality Assurance
Delivery, Storage and Handling
Drawings

PART 2 - PRODUCTS

Outside Plant Cable (Voice)
Lightning Protection
Backbone (Riser andTie) Copper Cabling
Backbone Voice Cabling
Backbone Copper Data Cabling
Horizontal Media (Station Cables)
Coaxial Cable (Video-RF)
Video Distribution Line Amplifier
Coaxial Cable Splitters
Information Outlet
Data Patch Panel
Voice (Horizontal) Termination Field
Voice Backbone Termination Field
Coax Patch Panel
Equipment Rack
Equipment Cabinets (Wall Mount)
Flexible Nonmetallic Innerduct and Fittings
Miscellaneous Materials
Surface Raceway
Telecommunications Ground

PART 3 - EXECUTION

General
System Topology and Cable Size Requirements
Innerduct
Cable Termination
Testing and Acceptance
Documentation
As-Built Construction Drawings
Warranty
As-Built Communication Cable Costs

RELATED WORK

Applicable provisions of Division 1 govern work under this section.

Section 26 05 00 – Common Work Results For Electrical
Section 26 05 33 – Raceway and Boxes for Electrical Systems
Section 26 05 36 – Cable Trays For Electrical Systems
Section 26 27 26 – Wiring Devices
Section 26 05 26 – Grounding and Bonding for Electrical Systems
Section 26 05 29 – Hangers and Supports for Electrical Systems
Section 26 05 53 – Identification for Electrical Systems

REGULATORY REFERENCES

All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Wisconsin Electrical Code and present manufacturing standards.

All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

Other applicable standards are as follows:

ANSI/IEEE C2 - National Electrical Safety Code

NFPA 70- 2002 - National Electrical Code

DILHR Chapter 16 - Wisconsin Electrical Code

TIA/EIA Standards 526-14A (OFSPT-14A), 526-7 (OFSPT-7), 568B.1 (Category 5e), 568B.2 (Category 6), 568B.3, 569A, 606A, and 607 (with exception)

IEEE/ANSI 142-1982 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

ICEA publication S-80-576-2002

DESIGN INTENT

The Horizontal (Station) Cabling System is based on the installation of 4-Pair Unshielded Twisted Pair UTP DATA Category 6 and 4-Pair UTP VOICE Category 6 Copper Cables. The cables shall be installed from the Standard Information Outlet (SIO) in the work area to the Telecommunications Room (TR) or Equipment Room (ER) serving that area and terminated as specified in this document.

Station cables shall be installed in conduit, in cable tray and in modular furniture. Outlets shall be mounted at a 45 degree angle on a wall-mounted box, on Surface Raceway and in Modular Furniture. Information Outlet locations are to be identified on Project Drawings.

Backbone Copper and Fiber Optic Cables (linking Equipment Rooms and/or Telecommunications Rooms) shall be installed in conduit in building riser pathways, in cable tray and/or free-air in as identified on the Drawings. Backbone Intra-building Fiber Optic Cabling shall be installed via Conduit and/or Cable Tray.

At the Main Equipment Room Data, Fiber Optic and Coaxial cable terminations shall be mounted on freestanding equipment racks; termination hardware related to Voice Cabling shall be [wall][rack] mounted. At the Entrance Room and at each TR.

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].

The contractor shall provide all labor and materials necessary to construct the system as described herein. This includes - but is not limited to - furnishing and installing cable, cable supports, innerduct, racking and termination components, termination, testing, labeling and documentation.

WORK SEQUENCE
During the construction period, coordinate telecommunications schedule and operations with the State of Wisconsin, Division of State Facilities Construction Representative and Owner.

SUBMITTALS
Under the provisions of Section 26 05 00 and Division 1, prior to the start of work the contractor shall submit:

Six sets of Manufacturer's Data covering all products proposed indicating construction, materials, ratings and all other parameters identified in Part 2 (Products) below.

Manufacturer's installation instructions, and one 2-foot section of each cable type to be utilized for final approval by the engineer. This two-foot section shall have the manufacturer's cable markings visible. Upon request, samples from every reel sent to the site shall be provided.

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.

Submittals shall be original catalog sheets, photocopies, or electronic format (ADOBE Portable Document format ".pdf") thereof. Facsimile (fax) sheets shall not be accepted.

Two sets of submittals. The engineer shall review the submittals and annotate them indicating approvals and shall return to the contractor.

Work shall not proceed without the engineer's approval of the submitted items.

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:

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.

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.

PROJECT RECORD DOCUMENTS
Submit and record documents under provisions of 26 05 00.

Accurately record exact sizes, locations and quantities of cables.

QUALITY ASSURANCE
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.

The contractor shall have been in this line of business for a minimum of five years and completed four (4) jobs of the magnitude specified in the following sections.

The installing contractor shall have at a minimum one Certified Installer trained to the latest industry standards to ensure the most reliable installation available. The Certified Installer shall have been trained by a company(s) that offer a minimum 15 year system warranty.

DELIVERY, STORAGE AND HANDLING
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. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 4 degrees C., the cable shall be moved to a heated (10 degrees C. minimum) location.

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.

DRAWINGS
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.

The contractor shall verify all dimensions at the site and be responsible for their accuracy.

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 days prior to the Bid Due Date.

PART 2 - PRODUCTS

OUTSIDE PLANT CABLE (VOICE)

Cables shall incorporate 24 AWG solid, annealed, bare copper conductors. All conductors shall be continuous and splice free. Bridge taps shall not be allowed.

Conductors shall be insulated with a thermoplastic skin. Insulated conductors shall be stranded into pairs of varying lay lengths in order to minimize cross-talk.

Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of 10 distinctive colors to identify 25 pairs in accordance to ICEA publication S-80-576-2002. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.

When cables of larger than 25 pairs are required, the core shall be assembled into 25-pair sub-units, each color coded in accordance to ICEA publication S-80-576. Cables with over 600 pairs shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow and violet. Binder color code integrity shall be maintained wherever cables are spliced

Cable shall meet the physical and electrical requirements of "Backbone Cable" as defined by TIA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard and shall conform to Category 3 performance specifications or better.

This cable shall be Underwriters Laboratory listed and be compliant with Article 800 (Communications Circuits) of the National Electrical Code (NEC) and be suitable for installation in underground duct or direct burial.

A flooding compound shall be applied over the core and to all surfaces of the shield/armor to resist moisture entry and to inhibit corrosion.

The cable core shall be filled with a waterproofing compound and wrapped with a non-hydroscopic core tape.

The cables shall contain an overall corrugated, coated aluminum shield, which is electrically continuous over its entire length.

The cable shall be finished with a black polyethylene jacket, which is sequentially printed with a footage marker at regular intervals.

LIGHTNING PROTECTION

A listed primary protector shall be provided on all inter-building backbone copper pairs. The protector shall be placed as close as possible to the building entrance. Lightning protection shall incorporate Gas Tube type devices containing a two element, wide-gap

gas tube providing a 265-425 VDC breakdown for lightning/over voltage protection and have a fail-safe design to protect personnel and equipment from exposure to sustained high voltages or currents. These devices shall be installed on each cable end, in the appropriate building entrance protector, which shall be supplied with a grounding lug that will accept a No. 6 ground wire. The ground lug shall be attached to the Grounding Bussbar. If a special tool is required to open the protection housing, this tool shall be provided on a one for one basis and turned over to the DSF representative at completion of the work. Terminal Blocks on the Protection Devices shall be the same type as used for termination of new cabling in the Equipment Room and Telecommunication Room(s).

BACKBONE (RISER AND TIE) COPPER CABLING

Backbone Voice Cabling

The Voice Backbone Cable shall link the Entrance Room, the Main Equipment Room and Telecommunications Rooms serving the building. These cables shall be terminated on 110 type blocks.

Voice Backbone Cable shall incorporate 24 AWG solid annealed Copper Conductors insulated with a polyvinyl chloride skin over expanded polyethylene. Conductors shall be twisted to form pairs and fully color-coded.

The Voice Backbone Cable shall be sized as detailed in Part 3 “Execution” of this Section.

Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of 10 distinctive colors to identify 25 pairs in accordance to ICEA publication S-80-576. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.

The Voice Backbone cable shall meet the physical and electrical requirements of “Backbone Cable” as defined by the TIA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard and shall conform to Category 3 performance specifications or better.

When cables of larger than 25 pairs are required, the core shall be assembled into 25-pair sub-units, each color-coded in accordance to ICEA publication S-80-576 (latest version). Cables with over 600 pairs shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow and violet. Binder color code integrity shall be maintained wherever cables are spliced.

The cables shall contain an overall corrugated, coated aluminum shield that is electrically continuous over its entire length.

This cable shall meet or exceed NEC Article 800 Type [CM][CMR][CMP] and be UL listed. Jacket shall be of fire resistant PVC. If this cable is installed in a Plenum area it shall be installed in the appropriate sized conduit.

Voice Backbone Cables, shall be Air Core with an 8-mil ALVYN Sheath.

All cables and equipment shall be furnished, installed, wired and tested by the contractor.

BACKBONE COPPER DATA CABLING
Backbone Copper Data Cables shall meet all of the specifications detailed above for "Horizontal Data Station Cables " plus the following:

Cable shall conform to TIA/EIA-568-B "Power Sum Crosstalk" standards with the requirement that the sum of multi-pair Crosstalk be no worse than the pair-to-pair Crosstalk of a 4-pair cable.

Link performance of any combination of up to six 25-pair and/or 4-pair cable segments totaling 90-meters in length or less shall be compliant with TIA/EIA-568-B requirements.

Color-coding of the pairs shall be per industry standards for 25-pair cables.

This cable shall be suitable for installation free-air, in building Risers, in Conduit and/or in Cable Tray and carry a [CMR CMP]rating.

HORIZONTAL MEDIA (STATION CABLES)
General
The Horizontal (Station) Cable System is based on the installation of Un-shielded Twisted Pair (UTP) DATA [Category 5e][Category 6] and VOICE (Telephone) [Category 5e][Category 6] copper cables to install from the work area to the wiring hub locations(s). Refer to the Floor plan Drawings(s) which identify the location of the wiring hubs and Standard Information Outlets (SIO) locations.

Voice and Data Station Cables shall be constructed of individually twisted pairs with 24-AWG insulated solid copper conductors.

All Cables and Termination hardware shall be technically compliant with and installed in accordance to the referenced TIA/EIA documents.

All cables shall be suitable for installation in the environment defined and shall meet a [CM][CMR][CMP] rating (or approved substitutes as defined by the 2002 NEC).

Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code and shall meet the specifications of NEMA (low loss), UL 444, and ICEA.

Pairs of all 4-pair cables shall be unshielded and shall be identified by a banded color code in which conductor insulation is marked with a dominant color and banded with a contrasting color. By pair number, the pair colors or dominant band are:

Pair 1: Tip - White/Blue; Ring - Blue (or Blue/White)
Pair 2: Tip - White/Orange; Ring - Orange (or Orange/White)
Pair 3: Tip - White/Green; Ring - Green (or Green/White)
Pair 4: Tip - White/Brown; Ring - Brown (or Brown/White)

Horizontal Data and Voice Station Cable (Copper)
All horizontal Data Station Cables shall terminate on modular Patch Panels in their respective Telecommunications Rooms (TR) or Equipment Room (ER) as specified on the drawings.

All horizontal Voice Station Cables shall terminate on modular Category 6 Patch Panels or Category 6 110 blocks in their respective Telecommunications Rooms (TR) or Equipment Room (ER) as specified on the drawings.

All cables, termination components and support hardware shall be furnished, tested, installed and wired by the contractor.

Transmission characteristics of the Data and Voice Station Cables shall meet full Category 6 performance criteria as defined by the referenced TIA/EIA documents. Refer to the Execution Section which details the required performance criteria of the completed Link of which the Cable is a part.

IMPORTANT: Cable and Termination Components (Jack, Patch Panel, Wiring Blocks) are specified to function as a System. The compatibility of the Cable to be installed with the proposed termination components shall be recognized and documented by the Termination Component Manufacturer.

The jacket color for Data cables shall be ***blue.***

The jacket color for Voice cables shall be ***gray.***

Cable shall be packaged in a way that minimizes tangling and kinking of the cable during installation. Examples are open reels or packages that incorporate a rotating reel.

Horizontal Voice Station Cable (Category 3 Copper)
All horizontal Voice Station Cables shall terminate on 110 type wall mounted termination blocks in their respective TR or ER as specified on the drawings.

All cables, termination components and support hardware shall be furnished, tested, installed and wired by the contractor.

Transmission characteristics of the Voice Station Cables shall meet full Category 3 performance as defined by the referenced TIA/EIA documents.

The Cable shall meet the following specifications.

- Twisted Pair 24 gauge
- Impedance 100 ohms +/- 15% @ 1 MHz
- Attenuation 2.6 dB/100 meters @ 1 MHz

COAXIAL CABLE (VIDEO-RF)

The contractor shall install the coaxial cables including video trunk cables, connectors, splitters, and line amplifiers as contracted, and as shown on the Drawings. Refer to Execution Section of this document.

Inside Cable

The inside vertical riser cable shall be a .500 trunk distribution type cable, with solid aluminum jacket.

The horizontal cable runs shall be RG-6.

Outside Plant Cable

Outside plant cable shall be a Type .500. This cable shall incorporate a flooding compound and be suitable for trunk distribution.

VIDEO DISTRIBUTION LINE AMPLIFIER

This contractor shall provide all Video Line Amplifiers. All video distribution line amplifiers shall support a video bandwidth of 750 MHz or higher. Line Amplifiers shall be equipped to include “plug-in” equalization variable slope and gain controls, and built-in diplex filters for standard sub-channel two-way operation with active return, which will support two-way interactive services. Maximum full gain shall be [45-50 dB]. The Video Line Amplifier shall be a trunk/bridge type with appropriate gain. The amplifier shall be powered.

COAXIAL CABLE SPLITTERS

This contractor shall provide all hard-line coaxial splitters to provide adequate distribution of all horizontal coaxial cable in each IDF and MDF. All splitters shall support a video bandwidth of 1 GHz. Hard-line cable splitter shall be [Manufacturer and Model Number]. Hard-line to F8 splitters shall be [Manufacturer and Model Number], or equivalent. Refer to the drawings for the proper device.

"TV" Coax (RG-6

Cable shall be listed as being suitable for use in environment defined and shall meet a CM rating (or better as defined by the 2002 NEC).

Basic Construction:
Center conductor - 18 AWG Copper Covered Steel; 0.040" O.D. (nominal); foamed polyethylene dielectric
Inner shield - aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric
Second shield - 60% 34 AWG bare aluminum braid wire
Third shield - non-bonded aluminum foil tape
Outer shield -42% 34 AWG bare aluminum braid wire
Outer Jacket - Flame retardant PVC

Impedance 75-Ohms

Capacitance 16.0 pF/ft (nominal)
Velocity of propagation 84.0%

INFORMATION OUTLET
Station cables shall each be terminated at their designated workstation location in the connector types described in the sub-sections below. Included are modular jacks (Voice and Data) Coaxial Connector assemblies. These connector assemblies shall snap into a mounting frame and exit flush All ports shall be installed such that the opening faces the floor. The combined assembly is referred to as the Standard Information Outlet (SIO).

SIO mounting configurations shall be as follows:
Flush where existing boxes are in place

Surface mounted on Systems Furniture (base panel) - Systems Furniture Type shall be defined prior to construction.

All data/voice jacks shall [be flush] [exit the frame at a 45 degree angle with the angle facing the floor].

The Telecommunications Outlet Frame shall accommodate:
1. A minimum of four Modular Jacks, Coaxial Connectors when installed on a Floor-mounted assembly.
2. A minimum of two Modular Jacks and/or Coaxial Connectors when installed on modular furniture.
3. The outlet frame shall incorporate a mechanism for adjusting the surface plate to a plumb position.

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.

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.

Wall Mount Outlet Faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

Where stand-alone "Data" or "Voice" only Jacks are identified, the SIO Frame shall be configured as to allow for the addition of one 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.

Any unused jack positions shall be fitted with a removable blank inserted into the opening.

[All Jacks and Connectors will be fitted with a dust cover. Modular Jacks shall incorporate a dust cover that fits over and/or into the jack opening. The dust cover shall be designed to remain with the jack assembly when the jack is in use. No damage to the Jack pinning shall result from insertion or removal of these covers. Dust covers, which result in deformation of the jack pinning, shall not be accepted.]

The faceplate of the SIO shall be constructed of [High Impact Plastic, Stainless]. Faceplate color shall (1) match the faceplate color used for other utilities in the building or (2) when installed in Surface Raceway (if applicable), match the color of the Raceway. [If stainless faceplates are used, then delete the wording relating to color.]

Different frame designs for locations which include fiber optic cabling verses those which terminate only Copper Cabling (UTP and/or Coax) are acceptable. Outlets which incorporate optical fiber shall be compliant with the above requirements plus:

1. Be a low-profile assembly;
2. Incorporate a mechanism for storage of cable and fiber slack needed for termination;
3. Position the fiber optic couplings to face downward or at a downward angle to prevent contamination; and
4. Incorporate a shroud that protects the optical couplings from impact damage.

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 voice jack as defined below, mount on a standard single gang outlet box or bracket and include mating lugs for wall phone mounting.

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.

Data and Voice Jacks
Data and Voice jacks shall be an 8-pin Modular Jack.

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

Data Jacks shall be pinned TIA-568A or TIA-568B with the pairs as follows:
Voice Jacks shall be pinned TIA-568A or TIA-568B with the pairs as follows:

TIA-568A:	Pair 1 – Pins 5 and 4	TIA-568B:	Pair 1 - Pins 5 and 4
	Pair 2 - Pins 3 and 6		Pair 2 - Pins 1 and 2
	Pair 3 - Pins 1 and 2		Pair 3 - Pins 3 and 6
	Pair 4 - Pins 7 and 8		Pair 4 - Pins 7 and 8

Transmission characteristics of the Data and Voice Jack shall be as required to meet the TIA/EIA [Category 5e][Category 6] performance criteria. Refer to the Execution Section which details the required performance criteria of the completed Link of which the Jacks are a part.

The Jack shall be UL verified and listed.

Jack contacts shall have a minimum of 50 micro-inches of gold plating.

Voice Jack
Voice jacks shall be non-keyed 8-pin Modular Jack (8P8C)

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.

Voice Jacks shall be pinned per the USOC standard with the pairs as follows:
Pair 1 - Pins 5 and 4
Pair 2 - Pins 3 and 6
Pair 3 - Pins 2 and 7
Pair 4 - Pins 1 and 8

Voice Termination hardware shall meet Category 3 performance specifications as defined by the referenced EIA/TIA documents.

Wall-mount Voice-Only Outlets
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 voice jack as previously defined, mounted on a standard single gang outlet box or bracket and include mating lugs for wall phone mounting.

F-Connector (RG-6 Coax)
RG-6 Coax cable shall be terminated at the Workstation and at the Telecommunications Rooms in a Male "F" type connector.

The Male F-Connector shall:

1. Be matched to the RG-6 cable type proposed by the contractor.
2. Be a single piece connector.
3. Incorporate a ½" crimp ring which uses hex or compression crimp.

When preparing the RG-6 cable for termination, manufacturer installation procedures shall be adhered to. Special care shall be taken to ensure the proper center conductor length as specified by the manufacturer.

The Male F Connectors shall be mated to Female/Female Feed-through Couplings at both the Outlet and Patch Panel locations. These couplings shall be matched to the Male F-Connector type. Couplings shall be of sufficient length as to allow for the Male F-Connector to fully seat (both sides).

IMPORTANT: It is the responsibility of the contractor to ensure that their proposed design considers the available mounting depth in both the existing wall boxes and possible Surface Raceway. This may include the provision of Right Angle Cable Plugs, Feed through Couplings or other means.

DATA PATCH PANEL
Data cabling shall be terminated at the Main Equipment Room and Telecommunications Rooms on panels incorporating Modular Jacks meeting the specifications for the Telecommunications Outlet detailed in the Section above.

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). On the Wall-mounted panels, this interface shall be on the front of the panel (same size as modular jacks) and be protected by a cover plate when in use.

Wall-mounted patch panels shall incorporate a standoff bracket to allow for cabling to be routed behind the panel.

The largest single patch panel configuration shall not exceed 72 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.

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.

The Data Patch Panel as a system (including jack, cable interface and intermediate components) must maintain [Category 5e][Category 6] performance per the referenced TIA/EIA documents. All pair combinations must be considered, with the worst-case measurement being the basis for compliance.

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.

The Patch Panel shall have color coded designation strips to identify cable count.

Transmission performance shall be maintained by the Data Patch Panel as a system (including jack, cable interface and intermediate components).

VOICE (HORIZONTAL) TERMINATION FIELD

At the Telecommunication Room(s) and Main Equipment Room, each Horizontal Voice Cable shall be terminated on high density 110 blocks. Wall mounted patch panels and terminal blocks must be mounted on a prepared surface consisting of 5/8 inch plywood securely fastened to the building walls. All six surfaces of the plywood must be painted with fire retardant paint.

Each horizontal row shall be cable of terminating six 4 pair groups (Station Cable).

Blocks shall identify pair position by color designation.

The blocks shall be designed to maintain the cable’s pair twists as closely as possible to the point of mechanical termination.

The voice termination field (blocks) must maintain [Category 5e][Category 6] performance per the referenced EIA/TIA documents. All pair combinations must be considered, with the worst-case measurement being the basis for compliance.

Each row of blocks shall be provided with a label holder which is to be used to identify the cable pairs.

The Voice Termination Hardware shall be 110-style.

1. Voice Horizontal Cabling Termination.
2. Four (4) Pair Termination Clips (e.g. C4) shall be used in the termination of Voice Station Cabling.

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.

Vertical Troughs incorporating [metal][plastic] 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 cabling is terminated.]

VOICE BACKBONE TERMINATION FIELD

At the Telecommunications Room(s) and Main Equipment Room, each Voice "Backbone" Cable shall be terminated on high density horizontal 110 blocks. Wall mounted terminal blocks must be mounted on a prepared surface consisting of 5/8 inch plywood securely fastened to the building walls. All six surfaces of the plywood must be painted with fire retardant paint.

Each horizontal row of the cross-connect block must be capable of terminating one 25 pair binder group (Backbone Cables). Backbone blocks shall be segregated clearly identifying their function.

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.

Blocks shall identify pair position by a color designation - Blue, Orange, Green, Brown and Slate (Backbone only)

The blocks shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.

The Voice Termination Hardware shall be 110-style.

1. Voice Backbone Cabling Termination
2. Five Pair Termination Clips (e.g. C5) shall be used in the termination of Voice Backbone Cabling

Patch Panels for Station Cabling

Where Fiber Optic Station Cabling is to be terminated, the enclosure shall be compliant to all of the above requirements plus the enclosure shall incorporate a storage mechanism designed as to allow simplified identification, access to and termination of individual optical fibers. This may be in the form of a Storage Cassette, Tray or other appropriate mechanism. The patch panel enclosure shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings - including those not terminated (if applicable) and/or those included in "Bid Alternates" (if applicable).

COAX PATCH PANEL

All terminated coaxial cables shall be mated to Female/Female "F" Series Couplings mounted on a panel.

The panels shall incorporate a dielectric (e.g. polycarbonate) insert on which the couplings are mounted to provide electrical isolation of connection points.

The panels shall incorporate cable management brackets at the rear of the panel on which to secure the RG-6 cables.

EQUIPMENT RACK

Free Standing Equipment Rack

At the Telecommunications Room, Equipment Racks shall be furnished and installed by the contractor to house Cable Termination components (e.g. Copper Data and Fiber Optic) and Network Electronics (by others). Refer to Part 3 ("Execution") of this Section for quantities required at each location. Where additional Equipment Racks are required or where existing racks are in place and none are required, it shall be so noted on the Floorplan Drawings.

The rack shall conform to the following requirements:

1. The rack shall comply with State Building Codes for the seismic area in which it is to be installed.
2. Rack shall be 84" in height and shall be self-supporting.
3. Channel uprights shall be spaced to accommodate Industry standard 19” mounting.
4. Rack must be constructed of aluminum and have either a coating or painted surface.

5. 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
6. Rack should be supplied with a supply of spare screws (minimum of 24).
7. Base footprint should be no smaller than 15”x20”.
8. Rack should be supplied with a ground bar and #6 AWG Ground lug.

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:

Horizontal Jumper Management Panels shall be painted steel/plastic (3.5" panel), have a minimum of five Jumper distribution rings (1.75" x 3.75" minimum dimension) and incorporate jumper routing clips (plastic) for individual jumpers.

At minimum, horizontal cable management hardware shall be 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 and (c) above and below each Fiber Optic Patch Panel.

Vertical jumper management shall provide for cable routing on front and rear of each rack and be 3½" 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.

Each rack shall be supplied with a minimum of 12 releasable (e.g. "hook and loop") cable support ties.

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. Routing of jumpers via the overhead ladder rack system is not acceptable. The proposed method shall be included in the submittals required by this document and shall be approved by the engineer prior to installation.

EQUIPMENT CABINETS (WALL MOUNT)
Where identified on the drawings, wall mounted equipment cabinets shall house all termination components installed under this contract.

1. Be of a “three-section” construction including (a) wall-mount section which incorporates cable entry, (2) center section and (c) door. Each section shall be hinged to facilitate access. Hinges shall be configurable to open LEFT OR RIGHT.
2. The wall-mounted section shall incorporate knock-outs (top and bottom) for cable access.
3. The door shall be solid. Door depth shall be 2-inches or greater.
4. Shall be at least 25-inches in width. (It is understood that this may require a custom configuration. Use of standard cabinet designs with extended mounting rails is to be considered).
5. Hardware mounting depth (from front of channel upright to wall) shall be 18-inches (minimum).
6. shall have a load-bearing capacity of 100-lbs or greater.

The cabinet shall be configured as to allow for adjustment of the channel uprights (front to rear) in 1-inch increments and be space to accommodate industry standard 19-inch mounting and tapped to accept 12-24 screws. The cabinet shall be vented to allow for airflow through the cabinet.

Cabinet(s) shall be equipped with vertical and horizontal cable management hardware, in the form of rings and guides, as to allow an orderly routing of optical fiber and twisted pair jumpers from the patch panel to the customer provided network equipment. At a minimum, one such horizontal jumper management panel shall be provided with each cabinet. Jumper management panels shall be 3-1/2” in height and have a minimum of five jumper distribution rings.

Each rack shall be supplied with a minimum of 12 releasable (e.g. "hook and loop") cable support ties and shall be supplied with a supply of spare screws (minimum of 24).

FLEXIBLE NONMETALLIC INNERDUCT AND FITTINGS

General

Flexible Non-metallic Innerduct (e.g. “Innerduct”) may be used as follows:

1. To segment conduit(s), increasing their capacity;
2. As protection to backbone fiber optic cables when installed in cable tray; and
3. As protection to fiber optic cable(s) within equipment rooms and Telecommunications Rooms.

Innerduct shall be corrugated.

Where not installed in a continuous length, innerduct segments should be spliced using couplings designed for that purpose.

Any vacant innerduct shall be equipped with a pull cord and capped at all ends to inhibit the entry of water and contaminants.

Nominal duct size shall be 1-inch (minimum).

Innerduct should be rated (e.g. General, Flame-retardant, Riser or Plenum) as required by the installation environment. Riser and Plenum innerduct shall be of a color contrasting to that of the "Standard" and Flame-retardant innerduct. The preferred colors are Orange ("Standard and Flame-retardant) and White (Riser and Plenum).

Flame-retardant Innerduct
Innerduct installed within buildings (not including riser paths) or utility tunnels shall meet all of the above General requirements plus:

1. Be fabricated of flame-retardant materials suitable for installation such environments, and
2. Meet or exceed all requirements for flame resistant duct as required by Bellcore TR-NWT-000356 (Section 4.33).

Riser-rated Innerduct
Innerduct installed within building riser shafts shall meet all of the above General requirements plus:

1. Be fabricated of flame-retardant materials suitable for installation such environments, and
2. Meet or exceed all requirements for flame propagation as specified by test method UL-1666 and referenced by the National Electrical Code (NEC) Section 770-53 for listed optical fiber raceways being installed in vertical runs in a shaft between floors.

Plenum-rated Innerduct
Be fabricated of flame-retardant and smoke inhibiting materials suitable for installation in such environments, and

1. Meet or exceed all requirements for flame propagation and emissions as specified by test method UL-910 and referenced by the National Electrical Code (NEC) Section 770-53 for listed optical fiber raceways being installed in ducts, plenums and other areas for environmental air, and
2. Meet or exceed all requirements specified by the National Fire Protection Agency (NFPA) 90A and 262 for Plenum spaces. Testing for fire and smoke characteristics shall be per UL-910.

MISCELLANEOUS MATERIALS
Voice Station Patch Cords
The contractor is to furnish ____ voice station patch cords (use the above quantity plus 20%) which are six inches or less in length and consist of an 8P8C plug (pinned 568A or 568B) and connected to an 8P8C jack (pinned USOC) with Category 5e/Category 6 cable.

Fiber Optic Patch Cables
The Fiber Optic patch cables shall be 62.5/125 and/or 50/125 (laser optimized) micron multi-mode fiber utilizing tight buffer construction. The fiber optic patch cables shall be minimum 1.5 meters in length.

Fiber Optic jumpers shall incorporate Ceramic or Metallic tipped ST-SC type connectors. Connector body shall be of materials similar to that used in the proposed couplings. Connectors used in fiber optic patch cables shall meet requirements set forth in the Fiber Optic section of this section.

Channels in duplex patch cables shall be of equal length.

Power Strip / Surge Suppressor
At the Main Equipment Room and at each Telecommunications Room, one Power Strip / Surge Suppressor shall be furnished and installed by the contractor to provide for powering of the network electronics (by others).

Power Strip / Surge Suppressor shall:

1. Be rack mountable (19-inch rack).
2. Be compliant with UL-1449, UL 1283 and UL-497A.
3. Provide Transient suppression to 13,000-A. Protection shall be in all 3 modes (hot-neutral, hot-ground and neutral-ground).
4. Shall meet or exceed IEEE 587 Category A and B specification.
5. Provide High Frequency Noise Suppression as follows:
   a. >20-dB @ 50-kHz
   b. >40-dB @ 150-kHz
   c. >80-dB @ 1-MHz
   d. >30-dB @ 6- to 1000-MHz
6. Provide a minimum of 320 Joules of AC Energy Absorption.
7. Be equipped with a 12-foot power cord.
8. Provide a minimum of six outlets.

SURFACE RACEWAY
It is anticipated that Surface raceway will be used in this project.

No exposed wire shall be permitted.

With the agreement of the Architect/Engineer, if a need arises to add telecommunications outlets in areas where the walls cannot be fished, the station wire serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, corridors, conference rooms or like facilities.

The non-metallic surface raceway shall have a screw applied base and have a snap on cover. Both the base and cover shall be manufactured of rigid natural PVC compounds.

The raceway shall originate from a surface mounted box located 14 inches off the floor and be attached to the wall and terminate above the ceiling. Raceway for a wall-mounted location shall originate from a surface mounted box located 48" off the floor.

The color of this raceway shall match the décor. All fittings including, but not limited to, extension boxes, elbows, tees, fixture boxes shall match the color of the raceway.

The raceway and all system devices must be UL Listed, exhibit nonflammable self-extinguishing characteristics, tested to specifications of UL94V-0 and be Category Compliant as defined by TIA/EIA 568B.

Refer to Section 26 05 33 “Raceway and Boxes for Electrical Systems” for metallic and/or non-metallic Raceway guidelines for this Project. Minimum bend radius shall be adhered to for UTP and fiber optic cable.

TELECOMMUNICATIONS GROUND

At each Telecommunications Room, the Main Equipment Room and at the Electrical Service Entry, a "Telecommunications Grounding Busbar (TGB)" shall be installed by the Electrical Contractor. Refer to Section 26 05 26 “Grounding and Bonding for Electrical Systems”.

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.

The contractor shall provide five sets of the tool(s) required to operate the security screw type used on telecommunications outlet faceplates in secure areas. These tools shall be new and unused.

PART 3 - EXECUTION

GENERAL

Optical Fiber and Copper Pair counts of the cables to be supplied are detailed on the Project Drawings. 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.

Refer to Project Drawings which indicate the cable routes to follow and the termination location(s) within each building. Duct allocation shall be coordinated as part of the construction.

It is the contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

Beginning installation means contractor accepts existing conditions.

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.

All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a “break-away” or other approved method.

The contractor will be responsible for identifying and reporting to the Site Coordinator(s) any existing damage to walls, flooring, tiles and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway or other hardware must be repaired by the contractor. Repairs must match preexisting color and finish of walls, floors and ceilings. Any contractor-damaged ceiling tiles are to be replaced by the contractor to match color, size, style and texture.

Where unacceptable conditions are found, the contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

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.

Cable pulling shall be done in accordance 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.

All wiring shall be run “free-air”, in conduit, in a secured metal raceway or in modular furniture as designated on the floorplan(s). All cable shall be free of tension at both ends.

Avoid abrasion and other damage to cables during installation.

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.

The Cable system will be tested and documented upon completion of the installation as defined in the Section below.

A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

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.

SYSTEM TOPOLOGY AND CABLE SIZE REQUIREMENTS
Backbone Cabling (Riser and Tie)
Backbone Cables shall be installed to link telecommunications rooms including:

The following details the requirements relating to each cable type.

Voice Backbone Cabling
Backbone Voice cabling shall be sized based on the following minimum pair counts (The pair counts shall include 30% growth to the nearest cable size). Cabling is to be terminated on 110-type blocks. The contractor shall bond the outer metallic sheath of the cable to an approved ground using a #6 AWG solid copper wire. This shall be as close as practical to the Building Entrance ground as defined by applicable code.

Station Cabling
Information Outlets cables with copper media (Voice and Data UTP and "TV" coax) shall be located as detailed on the Project Drawings.

The Bidder in determining materials quantities and routing should utilize these documents.

Station Cabling on each Floor shall be routed to the Telecommunications Room (TR) on that floor or to the designated TR if on another floor.

Station cables shall be run to the Information Outlet from the Telecommunications Room serving each area in conduit, free-air above drop ceiling, in cable tray and/or in modular furniture.

The maximum station cable drop length for Data and Voice UTP (Category 5e or Category 6) 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. [There is no restriction on the length of Category 3 voice cabling within a building.]

All cables shall be installed splice-free unless otherwise specified.

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.

Avoid abrasion and other damage to cables during installation.

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.

Where installed free-air, installation shall consider the following**:**

1. Cable shall run at right angles and be kept clear of other trades work.
2. Cables shall be supported according to code utilizing "J-" or "Bridal-type" mounting rings anchored to ceiling concrete, piping supports or structural steel beams. Rings shall be designed to maintain cables bend to larger than the minimum bend radius (typically 4 x cable diameter).
3. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 6-inches, another support shall be used.
4. Cable shall never be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires.
5. Cables shall not be attached to existing cabling, plumbing or steam piping, ductwork, ceiling supports or electrical or communications conduit.

Manufacturer’s minimum bend radius specifications shall be observed in all instances.

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.

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.

A coil of 4 feet in each cable shall be placed in the ceiling at the last support (e.g. J-Hook, Bridal Ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each station cable under 250-feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

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.

To reduce or eliminate EMI, the following minimum separation distances from 480V Power lines shall be adhered to:

1. Twelve (12) inches from power lines of 5-kVa.
2. Eighteen (18) inches from high voltage lighting (including fluorescent).
3. Thirty-nine (39) inches from power lines of 5-kVa or greater.
4. Thirty-nine (39) inches from transformers and motors.

All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.

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.

Station Cabling on Modular Furniture

Where furniture panels are installed to include contact with a wall, cabling shall be fed to the furniture panels via existing conduit.

Where modular furniture is installed without wall contact, the contractor shall install a [power pole]["poke-through" and route the station cabling via the floor below (but terminate at the TR on the floor on which the jack appears)]. The selection of the "poke-through" shall consider fill ratios, bend limits on the Category 5e/6 UTP and the eventual feed into the furniture partition.

Cabling shall be protected in the transition from the "Poke-through" or Wall Fittings to the modular furniture via a length of flexible plastic conduit or other approved protective means. Conduit fittings shall be compatible with the "Poke-through" and Wall Fittings proposed. There shall be no exposed cable in the transition to the modular furniture. Fill Ratio (Cable Area vs. Conduit Area) in each feed shall not exceed 40%.

For purposes of bidding, it is to be assumed that the cable pathway shall be limited to the bottom panel of the modular furniture only. Communications cables would be run through these channels to the jack location.

For purposes of bidding, it is to be assumed that it will be the responsibility of the contractor to punch and re-install the bottom molding panels on the modular furniture as required to accommodate the Communications cabling and SIOs. The panels shall be marked prior to installation by the owner to identify the desired location of the SIOs. Any discrepancy between the Project Drawing identifying Outlet locations and the markings should be brought to the attention of the Site Coordinator(s).

The SIO shall be secured to the panel via mounting tabs, pop-rivets, screws or other approved method. Use of adhesive tape is not acceptable. The method of securing the SIO to the panel shall not result in sharp protrusions (e.g. sheet metal screw tip) into the channel behind the panel.

Information Outlet

General

Information Outlets shall be flush mounted on wall-mounted boxes, in floor-mounted boxes, on Surface Raceway and on modular furniture.

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:

1. Standard Voice and Data Outlet 18-inches
2. Wall-Mounted Telephone Outlet (Standard Voice only) 54-inches
3. Wall-mounted Telephone Outlets for Wheelchair Persons:
    a. Approach head on per ADA regulations
    b. Approach parallel per ADA regulations

INNERDUCT

Innerduct shall be riser or plenum rated as required by the installation environment. At minimum, innerduct should extend to the ladder rack above the termination enclosure at system endpoints. Where not installed in a continuous length, innerduct segments should be spliced using couplings designed for that purpose.

All exposed innerduct is to be labeled at 35-foot (minimum) intervals with tags indicating ownership, the cable type (e.g. "Fiber Optic Cable") and the cables it contains.

Where required by the project design, fiber optic cable shall be installed in protective innerduct.

Contractor shall determine optimum size and quantity to satisfy the requirements of the installation ensure that the mechanical limitations - including Minimum Bend Radius - of the cable are considered.

The innerduct should extend into the termination enclosure at system endpoints.

Where not installed in a continuous length, innerduct segments should be spliced using couplings designed for that purpose.

CABLE TERMINATION

General

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 DSF project manager and A/E.

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.

Cable Termination - Voice UTP

Voice pairs shall terminate on wall mounted 110 type blocks at the Entrance Room, Main Equipment Room and Telecommunications Room. The contractor shall coordinate the placement of blocks with the engineer in order to integrate with other cabling.

Station Blocks shall be provided to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.

The contractor shall furnish and install cable management hardware (e.g. D Rings and cable guides) to neatly and securely route the cable from cable tray to the cable termination hardware.

The Height of the Voice Termination Field shall not exceed 6-feet (72-inches) above floor level to facilitate cable maintenance.

Blocks on which Backbone and 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 at the building entrance, it will be the responsibility of the contractor, in cooperation with the Owner, to coordinate placement of Voice Termination hardware with the Local Exchange Carrier(s) serving the site.

Cables shall be fed from below the Termination Hardware in a manner that will facilitate growth.

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.

Termination of Horizontal Voice (Station) cabling shall be accomplished by using four-pair (e.g. C4-type) clips. The twenty-fifth pair of each row on the 110 type block located in the IDF shall not be used for termination of horizontal voice cable.

Termination of Backbone Voice cabling shall be accomplished by using five-pair (e.g. C5-type) clips.

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 backbone cables and within 0.5-inch for Category 5e and Category 6 cables. The cable jacket shall be removed only to the extent required to make the termination.

A jumper wire spool holder shall be installed at the Main Equipment Room. Two full (1000-foot) spools of 24-AWG one-pair jumper wire, - shall be supplied with the holder. The spool holders shall be assemblies designed for that purpose.

Voice Multiplier Blocks
At the MDF, Voice "Multiplier Blocks" shall be installed to accommodate the potential for multiple extensions of a single line. Each Multiplier Block shall be formed by running short sections of Cross-connect wire vertically through each index strip on a 100 pair block (4 rows). Five (5) Pair connecting clips shall be used, these multiple connections shall be clearly marked on the designation strips. Jumpers can then be wired (by others) from this common point to as many cable terminations as required.

One (1) each such 100 pair block shall be so configured at each telecommunication room.

Cable Termination - Data UTP
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.

Data Patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.

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.

Cable Termination - Fiber Optic
ALL fibers shall be terminated using the specified connector type.

Fibers shall be positioned consecutively and mapped "position for position" between patch panels. There shall be no transpositions in the cabling.

Connectors from two cables shall never share a common coupling panel. Multi-mode and single mode optical fibers (where applicable) shall be segregated on the panels as to clearly identify the distinction between the fiber types.

All terminated fibers at the Telecommunications Rooms shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.

All couplings shall be fitted with a dust cap.

Fibers from multiple locations may share a common enclosure, however, they must be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure provided that they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g. “insert”).

Slack in each fiber shall be provided as to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of 1-meter (~39”) of slack shall be retained regardless of panel position relative to the potential work area.

Where "Loose Buffered" cables are installed, the 250um coated fibers contained in these cables may be terminated either by 1) splicing of factory terminated cable assemblies ("pigtails") or 2) the use of a "fan-out" kit. In the latter approach, individual fiber are to be secured in a protective covering, an Armid (e.g. Kelvar) reinforced tube for example, with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and sub assemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.3 dB for multi-mode fibers and 0.1 dB for single mode fibers (if applicable). Direct termination of 250 um coated fibers shall not be permitted.

Cable Termination - Shielded (T1)
Shielded cabling shall be terminated on 110-type blocks. The blocks shall be wall-mounted at all locations.

Blocks shall be sized to provide for a minimum 20% growth in capacity relative to the initial installation.

Consistency shall be maintained throughout the installation relative to conductor sequence on the blocks. Building Ground and Cable Shield Drain Wire shall appear on the pair immediately to the left of each two data pairs on the cross-connect fields. Building ground connections are to be on the left of this pair (e.g. positions 1, 7, 13, etc.), with the cable shield at its adjacent right (e.g. positions 2, 8, 14, etc.). Cable shield shall be connected to the Telecommunications Ground via a short jumper on the connecting block(s) (e.g. 1 to 2, 13 to 14, etc.).

Designation labels shall be color-coded YELLOW to identify the cabling as a Network Connection. Pairs shall be identified on the labels numerically. Ground and Shield shall be identified for each pair.

Cable Termination RG-6 Coax
Panels shall be sized to accommodate an additional 20% growth in the number of cables terminated at any given location.

All cables shall be terminated in the specified connector type and mated to female feed-through couplers mounted on the panels. Coaxial cables shall be dressed neatly at the rear of the panel and secured to cable management brackets per manufacturer guidelines.

Voice Cross Connects
The contractor shall be responsible for the "Cross-connect" wiring between the Station (horizontal) and Backbone Voice cabling.

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 25^{TH} pair position (50^{TH}, 75^{TH}, etc.) of each riser voice block shall remain vacant.

Fastening cables directly to support brackets with wire or plastic ties will not be accepted. All cabling shall be neatly laced, dressed and supported. Retainer Clips shall be used on each 110-type block to secure jumper wires on the wiring block(s).

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.

Equipment Rack (Free Standing)
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 wall. Alternately, overhead cable tray over which the cabling accesses the equipment rack(s) shall provide this function.

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 ~40" 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.

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.

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 placed below each Fiber Optic Patch Panel installed by the contractor. Additional Jumper Management panels may be required pending installation of other cable types on the rack. Refer to other sections (in particular 27 00 00 – “Communications Cable and Equipment") for guidance.

The rack(s) shall be grounded to the Telecommunications Ground Busbar (TGB) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket or GREEN jacket with one or more yellow stripes). (See NEC 2002, section 250.119.)

Identification and Labeling
Refer to Section 26 05 53 “Identification for Electrical Systems” for Identification and Labeling guidelines for this Project.

All Copper Backbone and Station Cables, Outlet Faceplates and Termination components (e.g. Voice Field and Data Patch Panel) shall be clearly labeled.

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.

Cooperation
The contractor shall cooperate with other trades and State personnel 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 to the State, 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.

TESTING AND ACCEPTANCE

General

The contractor is responsible to perform acceptance tests as indicated below for each sub-system (e.g. backbone, station, etc.) as it is completed

All tests shall be documented.

The contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the contractor shall provide a summary of the proposed test plan for each cable type including equipment to use used, set-up, test frequencies or wavelengths, results format, etc. The method of testing shall be approved by the engineer.

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

The contractor shall conduct acceptance testing according to a schedule coordinated with the DSF. Representatives of the Owner may be in attendance to witness the test procedures. The contractor shall provide a minimum of one 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.

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.

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.

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.

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.

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.

Voice Cabling (Copper UTP)
Backbone Cabling
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.

Voice Station Cabling (Category 3)
Testing shall be from the Jack at the SIO voice outlet in the Work Area to the Termination Block on which the cables are terminated at the TR or ER.

All horizontal "Station" cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, Wire Map (Conductor Position on the Modular Jack). Any defective, split or mis-positioned pairs must be identified and corrected.

OR

IMPORTANT: Where cross-connection of cabling sub-systems (e.g. Station and Backbone) by the contractor is specified, each subsystem shall be tested separately as defined above followed by a Voice Channel Test after the cross-connection is complete.

Voice Station Cabling (Category 5e and Category 6)
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 5e and Cat 6 cable testing, in this case, will be done with the patch cord. The cabling must pass all Cat 5e or Cat 6 TIA requirements. If the cable test fails only due to the length of the patch cord, the DSF will accept the cable as passing.

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.

Testing of the Cabling Systems rated at TIA Category 6 shall be performed to confirm proper functioning and performance.

Where cross-connection of cabling sub-systems (e.g. Station and Backbone) by the contractor is specified, each subsystem shall be tested separately as defined above followed by a Voice Channel Test after the cross-connection is complete.

Voice Channel
The end-to-end voice transmission between the building MDF and the Standard Information Outlet (Voice) including patch cords/jumper cables.

Voice Channel Test
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 MDF. 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.

Data Station Cabling (Category 5e and Category 6)
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 5e and Cat 6 cable testing, in this case, will be done with the patch cord. The cabling must pass all Cat 5e or Cat 6 TIA requirements. If the cable test fails only due to the length of the patch cord, the DSF will accept the cable as passing.

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.

Testing of the Cabling Systems rated at TIA Category 6 shall be performed to confirm proper functioning and performance.

Category 5e and Category 6 Performance Testing
"In addition to the above, Performance Testing shall be performed on all cables. Testing of the Transmission Performance of station cables (Category 6) shall include the following:

1. Length
2. Attenuation
3. Pair to Pair NEXT Loss (new limits)
4. PSNEXT Loss
5. Pair to Pair ELFEXT Loss (Equal Level Far End Cross-talk)
6. PSEFEXT Loss
7. Propagation Delay
8. Delay Skew
9. Return Loss

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

Category 5e Cable
Permanent Link Test

Frequency	TIA/EIA 568B.1 Insertion Loss Attenuation	TIA/EIA 568B.1 Next Pair to Pair Coupling	TIA/EIA 568B.1 PSNEXT Worst Case Loss	TIA/EIA 568B.1 ELFEXT Worst Pair to Pair Loss	TIA/EIA 568B.1 PSELFEXT Loss	TIA/EIA 568B.1 Return Loss Worst Pair
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

"PASS" on each cable and display the specified parameters - comparing test values with standards based "templates" integral to the unit.

Category 5e testing shall be per ANSI/TIA/EIA 568B.1Permanent Link test configurations and ANSI/TIA/EIA 568B.1 Category 5e.

Category 6 testing shall be per ANSI/TIA/EIA 568B.2 Permanent Link test configurations and ANSI/TIA/EIA 568B.2 Category 6.

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:

Category 5e Test Parameters:

Propagation Delay
The maximum propagation delay determined in accordance 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).

Delay Skew
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 in accordance to annex D of ANSI/TIA/EIA-568-B.2.

Category 5e 44ns between 1 MHz and 100MHz

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 5e 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.

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.

Category 6 Test Parameters:

Category 6
Cable
Permanent Link Test

Frequency	TIA/EIA 568B.2-1 Insertion Loss Attenuation	TIA/EIA 568B.2-1 NEXT Worst Pair to Pair	TIA/EIA 568B.2-1 PSNEXT Worst Case Loss	TIA/EIA 568B.2-1 ELFEXT Worst Pair to Pair Loss	TIA/EIA 568B.2-1 PSELFEXT Loss	TIA/EIA 568B.2-1 Return Loss
Mhz	Max. dB	dB	dB	DB	dB	dB
1.00	1.9	65.0	62.0	64.2	61.2	19.1
4.00	3.5	64.1	61.8	52.1	49.1	21.0
8.00	5.0	59.4	57.0	46.1	43.1	21.0
10.00	5.5	57.8	55.5	44.2	41.2	21.0
16.00	7.0	54.6	52.2	40.1	37.1	20.0
20.00	7.9	53.1	50.7	38.2	35.2	19.5
25.00	8.9	51.5	49.1	36.2	33.2	19.0
31.25	10.0	50.0	47.5	34.3	31.3	18.5
62.50	14.4	45.1	42.7	28.3	25.3	16.0
100.00	18.6	41.8	39.3	24.2	21.2	14.0
200.00	27.4	36.9	34.3	18.2	15.2	11.0
250.00	31.1	35.3	32.7	16.2	13.2	10.0

Propagation Delay
The maximum propagation delay determined in accordance to the ANSI/TIA/EIA – 568B.2 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).

Delay Skew
For all frequencies from 1 MHz to 250 MHz, Category 6 cable propagation delay skew shall not exceed 44ns/100m at 20 degrees C, 40 degrees C, and 60 degrees C. In addition, the propagation delay skew between all pairs shall not vary more than +/- 10ns from the measured value at 20 degrees C when measured at 40 degrees C and 60 degrees C. Compliance shall be determined using a minimum 100m of cable.

In order to establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an 8-position Category 6 Modular plug (8-pin) to facilitate testing. 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.

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.

Fiber Optic Cable
General
The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, the contractor shall provide cable manufacturer's test report for each reel of cable provided. These test reports shall include (1) manufacturer's on the reel attenuation test results at the specified wavelengths for each optical fiber of each reel prior to shipment from the manufacturer and (2) on-the-reel Bandwidth performance as tested at the factory.

Tests Prior to Installation
The contractor, at their discretion and at no additional cost to the Owner, may perform tests deemed necessary by the contractor to ensure integrity of any Owner furnished optical fiber. Tests may range from a simple "flashlight test" to an OTDR of each optical fiber of each cable reel prior to installation. Upon request, the contractor shall supply this test data to the engineer prior to installation.

Tests After Installation

Upon completion of cable installation and termination, the Fiber Optic cabling shall be tested to include:
1. Optical Attenuation ("Insertion Loss" Method)
2. Verification of Link Integrity (OTDR)

Optical Attenuation Testing
Optical Attenuation shall be measured on all terminated optical fibers in both directions of transmission using the "Insertion Loss" method. Measurement shall be inclusive of the optical connectors and couplings installed at the system endpoints. 100 foot access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made.

Multi-mode fibers shall be tested in accordance to the EIA/TIA 526-14A, Method B at 850□30 nm. Single mode fibers (if applicable) shall be tested in accordance to the EIA/TIA 526-7-1998. Method A.1. Testing shall be at 1300□20 nm.

Attenuation of optical fibers shall not exceed the values calculated at follows:

Attenuation (max.) = 2*C+L*F+S dB
where C is the maximum allowable Connector Loss (in dB), L is the length of the run (in kilometers) and F is the maximum allowable fiber loss (in dB/km). S is the total splice loss (# of splices * max. attenuation per splice).

OTDR Testing
All fibers even those that are left un-terminated (if applicable) shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Multi-mode fibers shall be tested at 850-nm (nominal). Single mode fibers (if applicable) shall be tested at 1300nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of short cable sections. Access jumpers of adequate length to allow viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used.

OTDR traces revealing a point discontinuity greater than 0.2-dB in a multi-mode fiber, or 0.1-dB in a single mode fiber (if applicable) at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that fiber by the Owner. The installation of that cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that cable and the associated terminations shall be replaced at the expense of the contractor.

RG-6 - Testing
A Time Domain Reflectometer (TDR) shall be used to verify cable length and to test for cable faults and breaks. A step-function high resolution Time Domain Reflectometer shall be employed for this test, such as the TEKTRONIX 1502C or the HEWLETT-PACKARD 1415A. The results shall be automatically plotted on an X-Y plotter with a Y axis voltage reflection coefficient resolution of .001 per division. The X axis will resolve down to 1" of cable. The TDR will sweep the cable at a rate no greater than 50' per second, or such lower rate as necessary to resolve cable faults to the 1" and .001 VRC level.

The cables shall be terminated with its characteristic impedance, and in the case of 70-75 ohm cable, an appropriate matching pad shall be used to match the analyzer to the cable. Cable shall be rejected if any single fault is observed of amplitude greater than .003 voltage reflection coefficient. Characteristic impedance shall also be measured at 5% of nominal value.

Cyclic faults (such as cable reel stress and tie drawdown) shall be limited to a voltage reflection coefficient of .005.

Shielded Cabling (T1) - Testing
Shielded "T1" Cables shall be free of conductor-to-conductor and conductor-to-shield shorts.

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

Shield and Drain wire continuity shall also be verified.

DOCUMENTATION
General
Upon completion of the installation, the contractor shall provide three full Documentation Sets to the engineer for approval. Documentation shall include the items detailed in the sub-sections below.

Documentation of Test Results shall be submitted in hard copy or in electronic form (preferred). Electronic documents may be submitted on CD-ROM (preferred) or 3½" diskettes 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.

Documentation shall be submitted within 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.

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.

Test Data - Copper Media
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).

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 (preferred) or (3.5" diskette).

Cross-Connect Data
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).

AS-BUILT CONSTRUCTION DRAWINGS
Drawings included with the specifications set shall be modified by the contractor to denote as-built information.

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.

The Division of State Facilities through the Consultant will provide floor plans in paper and electronic (".dwg", *AutoCAD*) 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 weeks prior to the scheduled occupancy of the affected floors.

The contractors shall annotate the base drawings and return to the A/E in hard copy (same plot size as originals) and electronic (*AutoCAD*) form.

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.

All fonts, color, layer, Model Space/Paper Space conventions established in the base drawings shall be retained by the contractor in preparation of the As-built drawings.

Prior to generation of the drawings, the contractor shall provide a sample file and test plot to the engineer for review and approval.

All documentation, including hard copy and electronic forms shall become the property of the State.

WARRANTY
This contractor shall guarantee all materials, equipment, etc., 2 years from date of substantial completion of this work. In the case of data cabling the contractor shall furnish complete [Category 5e][Category 6] system warranty consisting of no less than 15 years. This guarantee shall include all labor, material and travel time. In the case of [multi-mode][single mode] fiber cabling the contractor shall furnish a complete system warranty consisting of no less than 15 years.

AS-BUILT COMMUNICATION CABLE COSTS
The contractor determine the "installed" price for the telecommunication cabling: 1) the average installed cost of a Cat 6 voice and a Cat 6 data cable from the TR to the outlet jack, 2) the average installed cost for a coaxial run from the F connector to the AV source equipment, 3) the average installed cost for a single mode fiber cable (state the number of fibers/cable and average length of cable), and 4) the average installed cost for a multimode fiber cable (state the number of fibers/cable and average length of cable). The costs are to include material, labor, installation, testing, documentation, manuals, training, warranty; and the telecommunications proportion of the Schedule of Values consisting of general conditions, bond, mobilization, record drawings, punch list, cleanup, and demobilization. These costs are to be sent to Thomas W. Irwin, DSF..

End of Section 27 00 00

END OF DIVISION 27 – COMMUNICATIONS

Division 28 – Electronic Safety and Security

Section 28 31 00 – Fire Detection and Alarm

PART 1 – GENERAL

SCOPE
The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the new Fire Alarm System as shown on the drawings and as herein specified. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Description of Work
- Regulatory Requirements
- Manufacturer Provided Services
- Quality Assurance
- Qualifications
- Submittals
- Project Record Drawings
- Operation and Maintenance Manuals
- Product Delivery, Storage and Handling
- Spare Parts
- Supervision
- Power Requirements

PART 2 - PRODUCTS
- Enclosures
- Multiplex/Intelligent Fire Alarm Control Panel
- Operation - Multiplex/Intelligent Fire Alarm System
- Central Monitoring
- Remote Annunciator/Fire Command Center Panels
- Multiplex/Intelligent Peripheral devices
- Fault Isolator Module (FIM)
- Conventional Peripheral Devices
- Audio Visual Notification Appliances
- Printers and Terminals

PART 3 - EXECUTION
- General
- Raceways
- Free Air Wiring
- Conductors
- Device Mounting
- Identifications
- Manufacturer's Services
- Testing
- Warranty
- Training
- Maintenance Contract
- Special Considerations

RELATED WORK

The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the following project sections:
Section 26 05 00 - Common Work Results for Electrical (formerly section 16010)

Section 26 05 26 – Grounding and Bonding for Electrical Systems (formerly section 16170)
Section 26 05 29 – Hangers and Supports for Electrical Systems (formerly section 16190)
Section 26 05 33 – Raceway and Boxes for Electrical Systems (formerly sections 16111, 16112, and 16130)
Section 26 05 36 – Cable Trays For Electrical Systems (formerly 16114)
Section 26 05 53 – Identifications for Electrical Systems (formerly section 16195)
Section 26 27 26 – Wiring Devices (formerly section 16141)

DESCRIPTION OF WORK
Furnish and install a complete Multiplex/Intelligent Fire Alarm System. The intent is to provide a fully addressable fire alarm system as shown on the plans to be tied into the fire suppression system.

The complete installation shall be done in a neat, workmanlike manner in accordance to the applicable requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.

The New Fire Alarm System shall consist of a single Main Fire Alarm Control Panel (FACP), Fire Alarm Annunciator Panel (FAAP), unless a different design is submitted and approved.

The New Fire Alarm System shall be configured as a local protective signaling system, as defined in NFPA-72, and shall use/incorporate the following features, as a minimum:

1. The latest intelligent analog, addressable technology (detectors/sensors and modular panel equipment) currently available from the manufacturer
2. A Single-Channel, selective [non-selective], One-Way Voice Communications (EVAC) System - This EVAC System shall be designed to Automatically Generate particular tones, and shall allow properly trained personnel to make manual announcements to [the entire building] [the selected areas].
3. Non-Coded, Speaker-type Audible Notification Appliances

Manufacturers other than *Edwards* shall provide a fire alarm network command center panel capable of, but not limited to, the following:

1. Annunciation of each device and location.
2. Annunciation of tornado warning from this location.
3. Signaling Line Circuits (SLCs), connecting addressable field points to the associated Fire Alarm Control Panel, shall be configured as NFPA style 4 (Class B), with point supervision.
4. Network Connections, Data, Audio, and Signaling Line Circuits, which functionally link together multiple panels or Transponders shall be wired in an NFPA Style 6 (Class A) arrangement.

5. Initiating Device Circuits (IDCs) shall be limited to short runs from Monitor Modules to the connected device, unless specifically stated otherwise herein, and shall be configured as NFPA Style B (Class B), with individual zone supervision.
6. Notification Appliance Circuits (NACs) shall be configured as NFPA Style Y (Class "B"). Audible NACs serving Speakers shall be installed using shielded cable, such that the speakers do not generate unwanted noises, due to cross-talk with other circuits.
7. Data Circuits to Annunciators shall be configured as NFPA Style 4 (Class "B"). All annunciators shall be fully supervised.

The system shall be an intelligent/analog type, and shall consist of the following panels:

PANEL NAME:	PANEL TYPE:	PANEL LOCATION:
FACP	Main Fire Alarm Control Unit	
FAAP	Fire Alarm Annunciator Panel	
RFCC	Remote Fire Command Center	

REGULATORY REQUIREMENTS

The complete installation shall conform to the applicable sections of the latest edition of the following Codes and Standards:

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):

NFPA-70 National Electrical Code (NEC) Generally, and Article 760 in particular
NFPA-72 National Fire Alarm Code
NFPA 101 Life Safety Code
IBC International Building Code
IFC International Fire Code
IMC International Mechanical Code

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

UNDERWRITERS' LABORATORIES, INC. (UL)

UL-864 Control Units for Fire Protective Signaling Systems
UL-268 Smoke Detector for Fire Protective Signaling Systems
UL-217 Smoke Detectors for Single and Multiple Station
UL-521 Heat Detectors for Fire Protective Signaling Systems
UL-464 Audible Signaling Appliances
UL-1971 Visual Signaling Appliances
UL-38 Manually Actuated Signaling Boxes
UL-1481 Power Supplies for Fire Protective Signaling Systems

MANUFACTURER PROVIDED SERVICES

A manufacturer-trained service technician shall provide the following installation supervision. This Technician shall be certified by the equipment manufacturer, and shall have had a minimum of two years of service experience in the fire alarm industry.

The technician's name shall appear on equipment submittals and a letter of certification from the fire alarm manufacturer shall be sent to the engineer. The manufacturer's service technician shall be responsible for the following items:

1. Pre-installation visit to the job site to review equipment submittals and verify method by which the system should be wired.
2. Periodic job site visits to verify installation and wiring of system, and to perform any partial system programming – required to permit portions of the existing system to be removed.
3. Upon completion of wiring, final connections shall be made under the supervision of this technician, and final checkout and certification of the system.
4. At the time of final checkout, technician shall give operational instructions to the Owner and/or his representative on the system.
5. All job site visits shall be dated and documented in writing and signed by the Electrical Contractor. Any discrepancy shall be noted on this document and a copy kept in the system job folder that shall be available to the engineer any time during the project.

QUALITY ASSURANCE

Unless specifically stated otherwise, each and all items of the fire alarm system shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label.

Notification Appliances may be products of a single, different manufacturer – provided that the Primary Equipment Provider or Manufacturer provides written documentation of compatibility, and agrees to assume any and all responsibility for compatibility with the Control Equipment.

In addition to previously listed UL standards, all control equipment shall be listed under the following UL Standards:

UOJZ	UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
UL 864	Transient protection
UL 497B	Isolated Loop Circuit Protectors. Where fire alarm circuits leave the building, additional Transient protection must be provided for each circuit.
UL 1481	Power Limited Applications.

QUALIFICATIONS

All equipment shall be supplied by a firm, which specializes in fire alarm and smoke detection systems with a minimum of five years' documented experience. The company shall be an authorized distributor of the proposed equipment

All work shall be performed by a licensed contractor, who is regularly engaged in the installation and servicing of fire alarm systems. Proof of five years' documented experience and of factory authorization to furnish and install the equipment proposed shall be furnished prior to contract award, if required by Division of State Facilities.

Contractor shall be located within three hours of travel time or less from the site of this project.

SUBMITTALS
Under the provisions of Section 26 05 00 and Division 1, submit the following for approval prior to ordering any equipment in accordance to requirements of Division 1, General Conditions. Submit a total of 10 sets.

Copies of CAD Files (AutoCAD, latest version, or DXF Format) for the Fire Alarm floor plans will be made available to the successful bidder for preparation of the required shop drawings and as-builts

REQUIRED SUBMITTAL MATERIALS
The following items, and any additional items required per Section 26 05 00, shall be included within the submittal package:

Although they may be submitted under separate cover, Submittal Brochures / Booklets / Binders and Shop Drawings shall be submitted together, and shall be treated as a complete set.

COVER SHEET:
The submittals shall contain a cover sheet, which shall include the following information:

1. Submittal Date
2. Specification Section(s)
3. Fire Alarm Contractor (Contact Name, name, address, and telephone number)
4. Electrical Contractor (Contact Name, name, address, and telephone number)
5. Project Name, Project City, Project State, and Project Address.

TABS AND TABLE OF CONTENTS:
The Table of Contents shall appear immediately behind the Cover Sheet, and shall contain a complete listing of all of the tabs contained within the binder / booklet.

Tabbed index sheets shall be inserted into each of the binders, such that each binder is clearly sub-divided into sections. Tabbed sections shall be provided, at minimum, for the following:

One section for each building – ALL submittal data, which applies to any particular building, shall be located within the tabbed section for the corresponding building. All submittal data within each "building" section shall appear in the same order.

One section for manufacturer's data sheets – divided into sub-sections for the following:

1. Panel Equipment (Panels, Panel Components / Modules, Printers, Annunciators, etc.)
2. Addressable Field Devices (Initiating and Control / Monitoring / Isolation)
3. Non-Addressable Field Devices (Initiating Devices, relays, etc.)
4. Notification Appliances
5. Fire-Fighter Communications Equipment if applicable

EQUIPMENT LIST:
A complete equipment list of all components, including the following: Quantity, Manufacturer, Part Number, and Description. If the supplier uses different part numbers from those of the actual manufacturer, the actual manufacturer and part numbers as they appear – marked on the shipping box / packages, shall also be identified on this list.

Each Equipment List shall include a complete listing of the modules, components, and software included for each modular Fire Alarm Control Panel, Network Panel, Transponder, Outboard Gear Panel or Annunciator. Such items shall be listed in a manner that clearly indicates that such items are parts of / components of a larger unit. Simply stating a single part number and description for such panels shall be unacceptable.

A separate list shall be included for each section, with items grouped by system.

For projects involving multiple systems, separate equipment lists shall be provided - one for each system.

Spare Parts shall also be listed separately, and shall be identified clearly as "Spare Equipment".

PRODUCT DATA:
Manufacturer's product data sheets, and equipment description of all system components. These data sheets shall be highlighted or suitably marked, so that included items and options are indicated. On data sheets that include multiple products, products that are not used shall be crossed out.

Product Data Sheets shall be organized, in order, corresponding to the FIRST occurrence of the corresponding item on the equipment list

SEQUENCE OF OPERATION:
Complete sequence of operations of all functions of the system. This sequence of operation shall be custom-created for this particular job.

In order to satisfy this submittal requirement, it shall be acceptable to include copies of the "Operation" portions of the specifications, including any applicable schedules / other supplementary information. Copied specification pages shall be marked and highlighted, where the programmed operation will differ from the specified operation. Copied specification pages shall be marked "no changes", where no significant deviation will occur. Other acceptable alternatives shall include written narratives, organized in a logical manner, and Matrix Charts.

Where Matrix Charts are provided, such charts shall be organized and labeled clearly, and shall incorporate suitable levels of detail (refer to NFPA-72 (1999) A-7-5-2.2(9) for an example of an acceptable matrix chart). The Leftmost column of the Matrix Chart shall include groupings of initiating devices and other function switches. The Topmost Row shall include groupings of notification appliances and output devices.

BATTERY CALCULATIONS:
These calculations shall clearly illustrate both the Standby and Alarm loads, due to the various field devices and panel components / modules. It is generally recommended to submit such calculations in a "spreadsheet" format. These calculations shall include any reserve / additional capacity, as required elsewhere within these specifications. Final results shall indicate both the minimum battery capacity required and the capacity actually provided.

It shall be acceptable to provide Maximum / Full-Load calculations for items such as NAC Booster Panels. Where this is done, the calculation sheet shall be marked as, "typical of nnnx, nnny, nnnz …." (where nnnx, nnny, nnnz … = panel names).

AMPLIFIER CAPACITY CALCULATIONS
For all speakers plus all required spare capacity.

ADDRESSABLE DEVICE / DESCRIPTOR LIST - Prior to programming the system, submit a chart or printout, listing every system address provided for purposes of alarm initiation, status monitoring, supervised signaling, and auxiliary controls. This printout shall include the corresponding device type and field programmable "custom labels", as they will be displayed on the New System – at the FACP and Local Annunciator. The addresses listed within this document shall directly correspond to the addresses marked on the submitted floor plan drawings. This list will be modified as needed by the Owner and returned to the contractor for final programming in to the system.

NAC WIRE DROP CALCULATIONS:
Calculations shall be provided for at least one Notification Appliance Circuit (NAC) per building. This calculation should cover the "worst case" (longest and / or most heavily loaded) NAC(s) as installed within the facility. It is recommended that this calculation should follow a "spreadsheet" format, and should clearly indicate the following:

1. The name of the circuit.
2. Point of origin of the circuit.
3. Complete list of all devices served by the circuit, including location and type of each device.
4. Alarm Current Draw for each device, at the applied voltage.
5. Applied Voltage (Based on anticipated battery voltage after specified stand-by and alarm operation).
6. Acceptable Operating Voltage for each type of device on circuit.
7. Calculated Voltage at each device on circuit.

These calculations should mathematically prove that all Notification Appliances on the circuit will receive acceptable power for proper operation, under "worst-case-scenario" conditions.

SHOP DRAWINGS:
All submitted drawings shall be created using CAD, and shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are the same on all drawings. All drawings must be submitted and approved by the engineer before ordering or fabrication starts, but such approval will not waive any specification requirements unless specifically stated. DSF shall provide copies of the floor plan drawings, in AutoCAD or DXF format, to the successful bidder.

Each and every sheet of the Shop Drawings shall be clearly and prominently identified as "SHOP DRAWINGS – PREPARED BY: (insert name of contractor firm preparing the shop drawings)", and shall be clearly and visibly different from the Contract Documents / Bidding Drawings. As a minimum, the name and company logo for the Electrical Contractor and the Fire Alarm Equipment Vendor should be added to each sheet, and a revision date shall be inserted on each sheet.

The submitted Shop Drawings shall include the following types of drawings:

PROJECT-SPECIFIC DRAWINGS:
Project-Specific Drawings. These drawings shall include the following:

SYSTEM RISER DRAWING:
A separate riser drawing shall be furnished for each system. Each System Riser shall illustrate all fire alarm circuits, which serve the facility, and shall incorporate the following information, in a clear, concise format:

1. Point of origin of each circuit (usually a Panel, or a Module within a panel).
2. Circuit type and labeling.
3. Area served by each circuit.
4. Wire / cable type and size.
5. Locations of Panelboards where primary system power is obtained.

6. The following information for each Field Device:
    a. Device Type
    b. Circuit(s) to which device is connected
    c. Locations of any End-Of-Line Resistor (EOLR)
    d. (and the circuit terminated by any such EOLR)

BLOCK DIAGRAMS:
Showing layout and operation of the entire system.

FLOOR PLANS:
These drawings shall consist of edited versions of the Contract Documents, which shall include the following information:

1. Fire Department Response Location(s).
2. Annunciator Location(s).
3. Panel Location(s).
4. Device Addresses - The addresses shown on these drawings shall directly correspond to the chart or printout, as specified previously, which spells out specific information about each device, including the field programmable "custom label".

TYPICAL DEVICE / MODULE WIRING DETAILS:
Component and module wiring diagrams – intended to illustrate terminations and wiring connections to each typical Field Device (Detectors, Notification Appliances, etc.), and each typical panel component / module utilized within the system. This set of drawings shall only include diagrams for modules and components, which are actually used in the provided system(s).

These drawings shall incorporate clear labeling / nomenclature, which shall clearly indicate the corresponding field device or module, to which it corresponds.

OMISSION OF ANY OF THE ABOVE MATERIALS FROM THE SUBMITTALS SHALL RESULT IN AN IMMEDIATE REJECTION OF THE SUBMITTALS FOR THIS PROJECT. If the EC / FAC has any questions concerning the preparation of these materials, please contact the engineer.

DEPARTMENT OF COMMERCE PLAN REVIEW
REQUIRED DOCUMENTS (per building)
This project requires a submittal to the Department of Commerce for review and approval. The following details the requirements of the contractor and the A/E with regard to the fire alarm Department of Commerce submittal.

CONTRACTOR'S RESPONSIBILITY

1. Department of Commerce approval is required prior to the start of construction. The contractor shall prepare and submit the required documents in a timely fashion to meet this requirement. If the contractor starts construction before approval is given by the Department of Commerce, the contractor is responsible for all additional fees required by the Department of Commerce.
2. Submit five copies of the fire alarm shop drawings, cut sheets and calculations to the A/E for review. These items must be approved by the A/E prior to proceeding with assembling the Department of Commerce submittal materials.
3. After obtaining A/E approval, prepare four sets of the required fire alarm shop drawings that will ultimately go to the Department of Commerce. These shop drawings shall be signed and dated by the contractor or manufacturer taking responsibility for the shop drawings. Note that each shop drawing must be signed and dated unless there is a cover sheet, in which case only the four cover sheets need to be signed and dated. If the contractor did not modify the fire alarm device layout from the A/E prepared construction documents, a note may be placed on the shop drawings stating that the fire alarm device layout was by others. In this case the contractor is taking responsibility for the initiating and indicating circuit design, not the device layout. If the device layout is changed, such as additional NAC panels and associated smoke detectors, the shop drawings may not contain a note stating that the fire alarm device layout was by others, and the contractor takes full responsibility for the information on the shop drawings.
4. Prepare one bound booklet of the fire alarm system device cut sheets and all calculations (indicating device power calculations, voltage drop calculations and battery calculations). These booklets do not need to be signed and dated.
5. Send the documents described in items (c) and (d) above to the A/E.
6. If requested by DSF, A/E, Department of Commerce or its authorized representative, additional data pertaining to the construction, materials and equipment shall be submitted to the A/E to substantiate conformance to Comm 61 code.

A/E's RESPONSIBILITY

1. Complete the SBD-118 form, including signing the form as the Fire Alarm Designer.
2. Print four sets of the fire alarm construction documents prepared by the A/E, and apply the A/E's engineer or designer seal with signature and date.
3. Calculate and prepare the SDB-118 submittal fee. The fee is reimbursable by the State.
4. Request a review date with Department of Commerce, Division of Safety and Buildings by emailing the completed first page of the review application, SBD-118, to planschedule@commerce.state.wi.us. or, fax it to (877) 840-9172.
5. Assemble the submittal and send to the Department of Commerce, Division of Safety and Buildings.

WHERE TO SEND DOCUMENTS
Currently, Safety and Buildings fire protection and fire alarm systems plan reviewers are:

- Lynne LeCount LLecount@commerce.state.wi.us, (262) 548-8621, Waukesha
- Keith Glaunert kglaunert@commerce.state.wi.us, (262) 548-8604, Waukesha

FORMS AND INSTRUCTIONS
SBD-118 (R03/08) can be downloaded from: http://commerce.wi.gov/SBdocs/SB-Form118App.doc (word) or http://www.commerce.wi.gov/SB/docs/SB-Form118App.pdf (PDF)

Instructions for SBD-118 can be downloaded from: http://www.commerce.state.wi.us/SB/SB-Form118AppInstructs.doc (word) or http://www.commerce.state.wi.us/SB/SB-Form118AppInstructs.pdf (PDF).

Visit Department of Commerce, Division of Safety and Buildings Commercial Buildings Plan Review info website for additional information: http://www.commerce.state.wi.us/SB/SB-CommBldgPlanRevMoreInfo.html#7.

Email plan Review Submittal Questions to: planschedule@commerce.state.wi.us

Email Fire Alarm Questions to: fireprotech@commerce.state.wi.us

Once approved, Safety and Buildings will retain one of the sets, and will return three sets, which shall be distributed as follows:

(1) Copy shall be retained by the fire alarm contractor on-site, and shall be used as a reference / made available to any Department of Commerce inspectors, who may make periodic inspection visits to the site.

(1) Copy shall be forwarded to the Owner for their records.

(1) Copy shall be retained by the Division 26 electrical contractor, for their records. If the Division 26 electrical contractor and the fire alarm contractor are the same firm, this copy shall be kept on site, at or near to the Fire Alarm Control Panel.

PROJECT RECORD DRAWINGS
Contractor shall submit to the DSF Construction Superintendent the as-built drawings for the entire work done under this project prior to final payment.

Work shall be done on Auto CAD using the contract drawings provided to the contractor by DSF in the form of Auto CAD files. A hard copy of same shall also be submitted.

These drawings shall show:

1. Locations and addresses of Initiation Devices, Notification Appliances, isolation devices, status-monitoring devices, supervised signaling devices, and auxiliary control devices.
2. Circuit and Address information for each field device listed above.
3. Conduit layout and size.
4. Number/size/type/Color-Code of conductors in each conduit run.
5. Riser diagrams.
6. Location of end-of-line devices.
7. List of custom labels as installed for each address.

Riser diagrams shall include location of emergency 120VAC panel, panel designation and circuit number used to feed each fire alarm panel. Also, indicate if panel is backed up by an emergency generator.

Riser diagrams shall include locations (room or area number) of notification, initiating, end-of-line devices and addresses for all addressable field devices.

Also see requirements in Division 1, General Conditions.

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:

A. A material guide, which shall contain the replacement part numbers and description of all components used. If this information is included in an instruction section for any of the equipment, it will not be necessary to duplicate the list. In either case, the parts list shall be associated with its respective chassis, modules or kit wherein it is found. A total listing of parts without such grouping will not be acceptable.
B. Catalog data or literature.
C. Manufacturer's operating instructions.
D. Manufacturer's maintenance instructions.
E. Installation instructions.
F. Name, address and telephone number of source for parts (i.e. keys, guards, etc) not supplied by the Fire Alarm Manufacturer.
G. Copies of all approved shop drawings.
H. An updated copy of the submitted sequence of operation, revised to reflect any implemented changes.

PRODUCT DELIVERY, STORAGE AND HANDLING
Receive equipment at job site; verify applicable components and quantity delivered.

Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.

Do not install damaged equipment.

Store equipment in a clean, dry space and protect from dirt, fumes, water, and construction debris and physical damage. Make arrangements with the Owner at the pre-construction meeting for storage of equipment on the premises.

SPARE PARTS
Contractor shall provide the following spare parts in quantities shown:

Quantity:	Type of Device
(?)	Photoelectric smoke detectors
(?)	Heat detectors
(?)	Smoke and heat detector bases – "standard" 2-Wire Type
(?)	Monitor Module (of each type utilized in this project)
(?)	Control Modules
(?)	Duct detectors with housing, head, remote test station, and sample tubes
(?)	Ceiling-Mount Speaker Units.
(?)	Ceiling-Mount Speaker/strobe Units.
(?)	Speaker/strobe Units, with (#) cd Strobe
(?)	Strobe-Only Unit, of each intensity used on the project. (If devices with field-selectable candela are used, then a total of (#) such units shall be provided
(?)	Pull Stations
(?)	120 Vac smoke detectors
(?)	120 Vac smoke detectors with ADA strobe
(?)	System Detector base with sounder

SUPERVISION
The system shall report a TROUBLE condition when any supervised circuit becomes disarranged, disconnected, or is manually disabled or overridden. Each supervised circuit shall be independently protected for short-circuit conditions, and shall be arranged so that faults on any one circuit do not prevent the proper operation of any other circuit in the system.

The following devices/circuits shall be supervised, as a minimum:
1. ALL communications links.
2. ALL Signaling Line Circuits.
3. ALL Initiating Device Circuits.
4. All sprinkler flow and tamper switches.

5. ALL Notification Appliance Circuits.
6. Auxiliary manual control circuits.
7. Remote Control Relays / Control Modules.
8. Primary, AC Incoming power to the system.
9. The system's batteries.
10. System Expansion Modules.
11. Auxiliary module LED's.

The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

Each independently supervised circuit shall include a discrete LCD readout, to indicate disarrangement conditions per circuit.

POWER REQUIREMENTS

Primary 120 VAC power, to all Fire Alarm equipment shall consist of dedicated branch circuits. These circuits shall be of a 3-conductor type, including a suitably sized green ground wire – SHARED NEUTRALS AND CONDUIT GROUNDS SHALL BE UNACCEPTABLE.

Each control panel shall receive 120 VAC power via a branch circuit in one of the building's emergency load panels. Each such branch circuit shall have a "breaker lock" to prevent accidentally de-energizing of the power to the fire alarm panel. Circuit breakers shall be painted red and labeled "FIRE ALARM". If more than one power circuit is used, each circuit shall be properly labeled as "FIRE ALARM", and shall also be labeled with additional information – in order to indicate which fire alarm equipment is powered from each such circuit.

All fire alarm power supplies, as well as any other supplemental power supplies, shall be installed in compliance with NFPA-70 – National Electrical Code (Latest Edition).

The panel shall include a disconnect switch for the AC power inside a locked enclosure near the panel or within the panel itself. This switch shall be labeled "Fire Alarm Power Disconnect".

Where the new control panel is to remain at same location as the existing panel, the contractor may re-use the existing branch circuit, if it meets the previously stated requirements stated above.

The control panel shall include electrical power surge and transient protection. If problems are anticipated, due to electrical transients associated with periodic generator testing, then the fire alarm equipment supplier shall provide suitable power filtering / suppression equipment, as recommended by the equipment manufacturer.

The system shall include sufficient back-up battery capacity to operate the entire system as follows, upon loss of normal 120 VAC power:

1. For panels connected to Dedicated Emergency Power (Generator) Branch Circuits:
2. The Panel and associated devices shall operated in a normal (non-Alarm) mode for a period of 12 Hours. After the 12-Hour normal period has expired, sufficient capacity shall remain, such that the panel and associated devices shall operate in an Alarm mode (All Speakers EVAC) for a period of 15 minutes.

For panels, which are not connected to Dedicated Emergency Power (no Generator) Branch Circuits:

The Panel and associated devices shall operated in a normal (non-Alarm) mode for a period of 24 Hours. After the 24-Hour normal period has expired, sufficient capacity shall remain, such that the panel and associated devices shall operate in an Alarm mode (All Speakers EVAC) for a period of 10 minutes.

The panel shall include a power-limited, filtered and regulated battery charger. The charger shall be an automatic dual-rate (high rate/float maintenance) type. The charger shall charge a fully discharged battery to 70% in 12 hours. The charger shall monitor for AC fail/disconnect, low/no battery, and high battery level. The charger shall include switches and associated LEDs for high rate and AC disconnect. The charger shall provide a minimum of 5 AMPS regulated 24VDC for peripheral devices requiring +/-5% regulation and 8 AMPS at 24VDC for standard peripheral devices. The charger shall be designed specifically for, or shall be properly configured for the provided batteries, which shall be of one of the following types:

1. Sealed, Immobilized Electrolyte Lead-Acid type (“Gel-Cells”) – Types which require fluid level maintenance, or which vent significant amounts of Hydrogen shall be unacceptable.
2. Nickel-Cadmium (Ni-Cad) batteries.

All batteries used in conjunction with the fire alarm system shall be installed in accordance to NFPA-70 – National Electrical Code (Latest Edition).

If these batteries are not located within or immediately adjacent to the fire alarm equipment, the location of such batteries shall be clearly indicated within the fire alarm equipment served by them, and the batteries and their enclosure shall be clearly marked as “FIRE ALARM”

All external circuits requiring system-operating power shall be 24VDC and shall be individually supervised and fused at the control panel.

PART 2 - PRODUCTS

ENCLOSURES
All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

Cabinet shall be equipped with locks and transparent door panel providing tamper proof enclosure yet allowing full view of the various lights and controls as required above.

MULTIPLEX/INTELLIGENT FIRE ALARM CONTROL PANEL (FACP):
A Multiplex intelligent fire alarm system shall be installed within this building shall be provided with a minimum of one Fire Alarm Control Panel (FACP), as shown on the project drawings.

The control Panel shall be modular, expandable with solid state, microprocessor based electronics. It shall display through the front viewing window only those primary controls and displays essential to operation during a fire alarm condition.

The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. Software programming shall allow for full flexibility for selective input/output control functions based on the Boolean programming functions AND, OR, NOT, as well as, timing, and special coded operations. The system shall be able to use all of the above programming functions in combination with any number of inputs and outputs. The systems shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

Simple Addressable systems, which do not support Analog Addressable or Intelligent Addressable detection technology shall also be unacceptable.

[The] [Each] control panel shall provide the following as standards:
Analog Addressable or Intelligent Addressable Detection, supporting the following:

1. Drift compensation.
2. Sensitivity display in %.
3. Sensitivity adjustment.
4. Day/night sensitivity adjustment.
5. Auto Detector test to meet NFPA 72.
6. Alarm verification with tally counter.
7. Maintenance alerts.

The number of Signaling Line Circuits (SLCs) required for the specified quantity of addressable field devices and peripherals, plus 1 spare loop (SLC) for each 5 active loops. Each active loop shall include 10% spare capacity or a minimum of 10 additional devices.

The number of Audible Notification Appliance Circuits (Speaker NACs) required for the specified quantity of speakers plus 1 spare circuit for each 10 active circuits. Each active circuit shall include 25% spare capacity

The number of Visual Notification Appliance Circuits (Strobe NACs) required for the specified quantity of strobes plus 1 spare circuit for each 10 active circuits. Each active circuit shall include 25% spare capacity or a minimum of 4 additional 110 cd devices

1. 80-character liquid crystal display.
2. Printer interface.
3. History log file with a minimum of 800 events.
4. Field programmability.
5. Silent walk test.

The multiplex/intelligent system shall provide the ability to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history.

The LCD shall display the following information relative to the abnormal condition of a point in the system prior to acknowledgement:

40 characters for:

Point address and loop number (i.e. 555-L5)
Type of device (i.e. smoke sensor, pull station, water-flow)
Point status (i.e. alarm, trouble)

40 characters for:

Custom location label (i.e. 4th Floor - Room 444)

Keyboards or keypads shall not be required to operate the system during fire alarm conditions.

The following software functions shall be provided, from the built-in system keyboard / display:

1. Setting of time and date.
2. LED testing.
3. Alarm, trouble, and abnormal condition listing.
4. Enabling and disabling of each monitor point separately.
5. Activation and deactivation of each control point separately.
6. Changing operator access levels.

7. Walk Test enable / disable.
8. Running diagnostic functions.
9. Displaying historical logs.
10. Point listing.

The following hardware switches/functions shall be provided:

1. Acknowledge alarm or trouble.
2. Silence alarm or trouble.
3. Reset system after alarm.
4. Connect/disconnect Central Monitoring tie.
5. Provide manual evacuation (drill).
6. Bypass elevator interface.
7. Bypass AHU / Fan Interface.
8. Bypass door holders.

STATUS INDICATORS AND DISPLAYS

A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall also sound during each key-press to provide an audible feedback to ensure that the key has been pressed properly.

The 2-line by 40-character liquid crystal display shall be backlit for enhanced readability.

A cursor shall be visible on the LCD when entering information.

Scrolling through menu options or lists shall be accomplished in a self-directing manner in which prompting messages shall direct the user

CONTROLS

The following controls shall be accessible with the front door open.

1. Manual evacuation (drill).
2. EVAC Microphone, and associated Audio Controls and Indicators.
3. LED / LCD Test Switch.
4. Key pad for data input and microprocessor control.
5. Bypass Function Switches and LEDs for the following:
   a) Central Monitoring Bypass
   b) Elevator Interface bypass
   c) HVAC / Fan Interface bypass
   d) Door holder release bypass

LED SUPERVISION

All slave modules LEDs shall be supervised for burnout or disarrangement.

ACKNOWLEDGMENT

Two methods of acknowledgment for each abnormal condition shall be provided. One may be chosen depending on the NFPA requirements.

First method - Acknowledge one event at a time from an unacknowledged list of events:

Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and require another acknowledge button. Press to acknowledge only the displayed point.

After all points have been acknowledged, the LEDs shall glow steadily and the Sonalert will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message "END of LIST".

Second method- Pressing the appropriate acknowledge button shall globally acknowledge all points.

SILENCING
If an alarm condition exists and the "Alarm Silence" button is pressed, all alarm audio [and visual] notifications appliances shall cease operation. [The strobes shall remain active until the system is reset.]

If trouble conditions exist in the system and the "Trouble Silence" button has been pressed, the aural trouble signal shall cease, but shall resound at time intervals to act as a reminder that the fire alarm system is not in a normal operating mode. Both the time interval and the trouble reminder signal shall be programmable to suit the Owner's application.

RESET
The SYSTEM RESET button shall be used to return the system to its normal state after an alarm condition has been remedied.

Should the Alarm Silence Inhibit function be active, the system shall ignore all key presses. An indication of enabling and disabling the inhibit state shall be provided as a feedback to the operator.

BYPASS FUNCTIONS
Bypass Switches shall be configured such that whenever any bypass function is active, a Trouble status condition shall be reported by the system, per the Trouble Sequence. The trouble message shall indicate the active function(s). Bypass LEDs shall be configured such that LEDs corresponding to the active function(s) shall illuminate, and shall remain lit until the associated bypass function is de-activated (until the system is restored to normal operating status). Switches and LEDs shall be provided for the following functions:

Central Monitoring Bypass - When this bypass function is active; reporting of various status conditions to the reporting system shall be disabled.

Elevator Interface bypass - When this bypass function is active; actuation of the Control Modules or Supervised Relays, which interface to the Elevator Controls and to the Shunt-Trip Circuit Breaker(s) shall be prevented.

HVAC / Fan Interface bypass - When this bypass function is active; actuation of the Control Modules or Supervised Relays, which interface to the AHU / Fan starters / Temperature Controls, and to any Smoke Dampers shall be prevented. (Smoke Control System bypass shall be accomplished via the separate, previously specified manual controls).

Door holder release bypass - When this bypass function is active; actuation of the Control Modules or Relays, which cause release of the Door Holders shall be prevented.

ACCESS TO OPERATOR FUNCTIONS:

The following Operator Function Access Restrictions shall be adhered to as closely as possible. Where system limitations do not allow for the restrictions to be configured exactly as listed, alternate methods will be considered, and shall be brought to the attention of the engineer prior to bidding:

ACCESS LEVEL 1 - BASIC OPERATOR FUNCTIONS:

ACKNOWLEDGE – allows Basic Operators to acknowledge ALARM, TROUBLE, and SUPERVISORY conditions, and to view the lists / logs associated with these functions.

SIGNAL SILENCE – allows Basic Operators to silence the audible signals. The system shall not permit signals to be silenced during “alarm silence inhibit mode” (if “Inhibit Mode” is utilized).

SYSTEM RESET – allows Basic Operators to Reset the Fire Alarm System. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user through the reset process with simple English language messages.

ACCESS LEVEL 2 - HIGH SECURITY FUNCTIONS:
Changes to the linkage of Operator Functions to Access Level / Pass-Code Profiles may affect the ability of individuals to access required functions. Because of this, access to this linking function shall also be appropriately secured.

ACCESS LEVEL 3 - OTHER FUNCTIONS:
These functions shall include, but shall not be limited to:

1. Enable / Disable Points.
2. Perform “Override” Functions / Features.
3. Generate Hard-Copy, Printed Reports.

4. Add / Delete / Change Pass codes, and associated links to system features.
5. Set / Change System Clock.
6. Set / Change Sensitivity of Detectors.
7. Clear History Logs.

POINT LISTING

1. All points list by address.
2. Monitor point list.
3. Signal/speaker list.
4. Auxiliary control list.
5. Feedback point list.

HISTORY LOGGING

The system shall be capable of logging and storing the last 800 events (alarm and trouble) in a history log. These events shall be stored in a battery protected random access memory.

The following historical alarm/trouble log events shall be stored:

1. Alarms
2. Alarm Acknowledgment
3. Alarm Silence
4. System Reset
5. Alarm Historical log cleared
6. Trouble conditions
7. Supervisory alarms
8. Trouble acknowledgment
9. Supervisory acknowledgment
10. Alarm Verification tallies
11. Walk Test results
12. Trouble Historical log cleared

SILENT WALK TEST WITH HISTORY LOGGING

The system shall be capable of being tested by one person. While in testing mode the alarm activation of an alarm-initiating device shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after the logging of the alarm.

The momentary disconnection of an initiating or indicating device circuit shall be silently logged as a trouble condition in the historical data file. The panel shall automatically reset itself after logging of the trouble condition.

Should the silent walk-test feature be on for an inappropriate amount of time (30 minutes max.) it shall revert to the normal mode automatically.

The panel shall have the capability of dividing the system into distinctive walk test groups, a minimum of 8 groups.

Should an alarm condition occur from an active point, not in walk test mode, it shall perform operations described above.

After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.

WATCH-DOG TIMERS
The system shall include independent "Watch-Dog" timers to detect and report failure of any microprocessor circuit, memory, or software.

FIELD PROGRAMMING
The system shall be fully programmable, configurable, and expandable in the field without the need for special tools or PROM programmers and shall not require replacement of memory IC's. All programming may be accomplished through the standard control panel keyboard or a keyboard at the printer, or the use of a PC. All programs shall be stored in non-volatile memory.

All programming or reprogramming shall be done by the supplier at no charge until the owner accepts the system.

SOFTWARE MODIFICATIONS
The system shall be capable of being programmed by means of a Field Configuration Program (FCP) allowing programming to be downloaded via portable computer from any node on the network.

Provide the services of a factory trained and authorized Technician to perform all system software modifications, upgrades, or changes. Response time of the Technician to the site shall not exceed 4 hours.

Provide all hardware, software, programming tools, access codes, and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

If the system access code is either a hardware key or a software key, the Contractor/Vendor shall provide the proper key to meet the above requirements."

TERMINAL/PRINTER INTERFACE
Fire Alarm Control Panel shall be capable of operating remote CRTs (serial data terminal) and/or printers.

Each output shall be ASCII, from an EIA RS-232-C serial data connection with an adjustable baud rate.

A minimum of one such RS-232 port shall be provided.

Each RS-232-C port shall be capable of being configured for either a CRT or a printer.

One such port shall be configured for a supervised connection to the Fire Alarm System printer.

One such port shall be configured for non-supervised connection to the CRT or Laptop.

Data amplifiers or short-haul modems shall be used to increase CRT or printer line distance, if required.

SIGNALING LINE CIRCUITS:
The system must provide communications with intelligent addressable initiating and control devices individually. These devices shall be individually annunciated at the control panel [and FAAP] [and RFCC]. Annunciation shall include the following conditions for each point:

1. Alarm
2. Trouble
3. Open
4. Short
5. Device missing/failed

All intelligent addressable initiation and control devices shall have the capability of being disabled or enabled individually.

Systems that require factory pre-programming or EPROMs to add or delete devices shall be unacceptable.

The communication format must be a completely digital poll/response protocol to allow t-tapping of the Signaling Line Circuit wiring. Systems that do not utilize full digital transmission protocol are not acceptable.

Special-purpose Isolator devices shall be used to provide further isolation / protection of sections of the Signaling Line Circuits. Areas served by Signaling Line Circuits shall be isolated as specified within the “scope” portion of this specification. The following Isolation devices shall be acceptable for use in performing this function:
Isolator Modules – Field Mounted.

OPERATION: MULTIPLEX/INTELLIGENT FIRE ALARM SYSTEM

PRIORITY:

Fire Alarm status conditions shall have the highest priority.

Supervisory status conditions shall have the second highest priority.

Trouble status conditions shall have the lowest priority.

STAND-BY MODE:

Under normal condition the front panel shall display a "System is Normal" message and the current time and date

SYSTEM RESPONSE

The time delay between the Alarm activation of an initiating device, and the automatic activation of the Notification Appliances and the annunciation of the Alarm status condition at the FACP and annunciators shall not exceed 5 seconds.

For response-time purposes, the manual actuation of an Audio Control Switch - associated with the one-way voice communications system - shall be instantaneous and shall be treated as if it were manual alarm activation.

ALARM SEQUENCE:

The following events are not required to occur in the stated order. However, ALL automatic responses must be initiated within the time interval allotted by UL and NFPA codes and standards.

This “Fire Alarm Sequence” shall be initiated upon receipt of one of the following, valid Fire Alarm status conditions:

Actuation of any Manual Pull Station, any Fire Protective Sprinkler System, any other Automatic Fire Suppression System, from any Smoke Detector, any addressable Heat Detector, any beam-type Smoke Detectors, any non-addressable Heat Detector

The system alarm operation, subsequent to the activation of any of the conditions listed above, shall be as follows:

The EVAC System shall automatically initiate “EVAC” Mode. All audible notification appliances (Speakers) [within the building] [within the affected Notification Area(s)] shall sound, using a sequence that is compliant with NFPA-72 – including an Alert Tone and a Digital Voice Message. The Alert Tone and Digital Message shall be repeated a minimum of three times, and shall continue to be repeated until the Audible Notification Appliances are Silenced, until a Manual Announcement is Made, or until the system is Reset.

All visual notification appliances [within the building] [or within the affected Notification Area(s)] shall flash continuously until the system is [acknowledged] [reset].

Any subsequent alarm shall reactivate the alarm audible [and visual] notification appliances [within the building] [within the affected Notification Area(s)].

All doors normally held open by door control devices [within the building] [within the affected Notification Area(s)] shall release.

[Alarm outputs connected to the facility reporting system shall be activated.]

The system Alarm LED shall flash on the FACP [and the FAAP] [and at the RFCC], until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on.

A subsequent alarm received from another device shall flash the system alarm LED on the FACP [and the FAAP] [and at the RFCC]. The LCD display shall show the new alarm information.

A pulsing alarm tone shall occur within the FACP [and the FAAP] [and at the RFCC] until the event has been acknowledged.

The system shall have a single key that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time and date of each occurrence.

A programmed Alarm Message shall appear on the FACP [and the FAAP] [and at the RFCC] LCD displays. These field programmable messages shall be revised, as directed by the Owner, during shop drawing review. The alarm shall be displayed on an 80-character LCD display as follows:
40 characters for:

- Point address and loop number
- Type of device
- Point status

40 characters for:

Custom location label

AUTOMATIC ALARM VERIFICATION:
The initial Alarm activation of any system smoke detector shall initiate an alarm verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, after 20 seconds and within 30 seconds after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within 30 seconds, the system shall resume normal operation. The alarm verification shall operate only on

single smoke detector alarm. Other activated initiating devices or multiple smoke detector alarms shall be processed and reported immediately.

The alarm verification operation shall be selectable by device or by group for addressable detectors and by IDC for non-addressable smoke detectors. Automatic Alarm Verification shall be enabled for all smoke detectors [including resident room smoke detectors if they are connected to the fire alarm system].

SELF-TEST AND AUTOMATIC DRIFT COMPENSATION:
The control panel shall continuously perform an automatic self-test routine on each Smoke Detector, which will functionally check detector electronics and ensure the accuracy of the values being transmitted to the control panel. Any detector that fails this test shall indicate a "**SELF TEST FAILED**" trouble condition with the detector location at the control panel.

All Intelligent Addressable Smoke Detectors used on this project shall incorporate automatic drift compensation / automatic sensitivity monitoring and adjustment, as described within the “definitions” portion of this specification section.

OPERATOR INTERFACE / MAINTENANCE FEATURES FOR AUTOMATIC SMOKE DETECTION:
An operator at the control panel shall have the capability to manually access the following information for each detector:

1. Primary status.
2. Device type.
3. Present average value.
4. Present sensitivity value selected.
5. Peak detection values.
6. Detector range (normal, dirty, etc.).

Values shall be in "percent of smoke obscuration" format so that no interpretation is required by the operator.

An operator at the control panel shall have the capability to manually control the following for each detector:

1. Clear peak detection values.
2. Enable or disable the detector.
3. Clear verification tally.
4. Establish alarm sensitivity.
5. Control a detector's relay driver output.

It shall be possible to program the control panel to automatically change the sensitivity settings of each detector based on time-of-day and day-of-week.

The control panel shall clear a “Detector dirty” trouble after a detector has been removed from its base cleaned and replaced.

ELEVATOR RECALL

After any elevator lobby, machine room, or shaft smoke detector alarm is verified, it shall, in addition to the operations listed in the “Fire Alarm Sequence”, cause Phase I Emergency Recall Operation according to the following sequence:

If the alarmed detector is located on any floor other than the designated level of egress, an Addressable Control Module or a supervised remote relay shall be actuated. This Control Module / Relay shall be located within three feet of the elevator controls, and shall cause the associated cabs to be recalled to the designated recall floor.

If the alarmed detector is located on the designated level of egress, an Addressable Control Module or a supervised remote relay shall be actuated. This Control Module / Relay shall be located within three feet of the elevator controls, and shall cause the associated cabs to be recalled to the alternate recall floor.

If the alarmed detector is located within the shaft, or within the machine room, an Addressable Control Module or a supervised remote relay shall be actuated. This Control Module / Relay shall be located within three feet of the elevator controls, and shall cause the “Fire Hat Lamp” at the associated Fire Service Control Station provided by Elevator Contractor / Owner to Flash. This lamp illuminates steadily, in response to elevator lobby recall conditions.

ELEVATOR SHUNT TRIP

The intended function of elevator Shunt-Trip operation is to disable power to the Elevator prior to Elevator Shaft or Machine Room Sprinkler Actuation.

Elevator shaft and Machine Room Heat Detectors shall be configured as follows:

Detectors shall be configured for FIXED TEMPERATURE-ONLY OPERATION.

Detectors shall have a lower actuation temperature than the sprinkler heads within the shaft and machine room. The EC shall coordinate this information with the Fire Protection Contractor. Detector shall be installed within 2 feet from the sprinkler head.

Detectors shall have a lower response-time index than the sprinkler heads within the shaft and machine room. The EC shall coordinate this information with the Fire Protection Contractor.

If the alarmed heat detector is located within the elevator shaft, or within the machine room, an Addressable Control Module or a supervised remote relay shall be actuated. This Control Module / Relay shall be located within three feet of the shunt-trip circuit breaker, and shall interrupt power to the elevator. If the elevator is hydraulic, a second

Control Module Contract shall allow elevator auxiliary power to lower the elevator to the proper level. Aux. power, if needed, shall be furnished by the elevator contractor.

The Power Source, which is used to actuate each elevator shunt-trip circuit breaker, shall be individually supervised by the FACP.

MANUAL DRILL
A manual evacuation (drill) switch shall be provided to operate the alarm indicating appliances without causing other control circuits to be activated.

LED AND LCD TEST
Activation of the Lamp Test switch shall turn on all LED indicators, LCD display, and the local sounder and then return to the previous condition.

SYSTEM DIAGNOSIS
The system shall include special software to detect, diagnose and report failures and isolate such failures to a printed circuit board level.

SILENT WALK TEST WITH HISTORY LOGGING
The actuation of the "Walk Test" switch/program at the control panel shall activate the "Walk Test" mode of the system, which shall cause the following to occur:

1. The Output Contacts, which provide the interface to the Fire Alarm System Reporting shall be bypassed.
2. Control relay functions shall be bypassed, such as door holders, elevator capture, fan shut down, etc.
3. The audio and visual circuits shall be bypassed.
4. The control panel shall show a trouble condition.
5. The alarm activation of any initiation device shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after the logging of the alarm.
6. Any momentary opening of an initiating or indicating appliance circuit shall be silently logged as a trouble condition in the historical data file.
7. The panel shall automatically reset itself after logging of the trouble condition.
8. If the system becomes inactive for a period of longer than 10 minutes the panel shall default to normal fire alarm functions.

It shall not be required to manually restart or reboot the fire alarm panel after a silent walk test is completed.

CENTRAL MONITORING
The new Fire Alarm System shall be interfaced to the following systems utilizing direct connection, for remote reporting of various conditions:

The interface between the reporting system(s) listed above and the new Fire Alarm System shall be configured as follows:

The Fire Alarm System shall provide contact closure outputs for the following conditions:

1. Fire Alarm: This contact shall actuate in response to any Fire Alarm status condition, other than Sprinkler Water Flow.
2. System Trouble: This contact shall actuate in response to the occurrence of any Trouble status condition on the Fire Alarm System.

The contractor installing the new Fire Alarm Systems shall be responsible for coordination of the Fire Alarm System connections to these system(s), for all wiring and conduit between these system(s), and for all terminations at the Fire Alarm end of such interface wiring. All such wiring, raceway, and terminations shall be included per the Base Bid.

REMOTE ANNUNCIATOR

Where shown on the plans, provide and install Annunciator FAAP.

Each panel shall incorporate an Alphanumeric LCD Annunciator, which shall functionally duplicate the FACP display, as well as standard controls for Acknowledge, Silence, and Reset.

ANNUNCIATION FEATURES

The Annunciator portion of each panel shall consist of the standard, compact-size LCD Alphanumeric Annunciator, as manufactured by the Fire Alarm System Manufacturer. This unit shall mimic the display assembly of the FACP, and shall incorporate the following features:

1. LCD Display
2. Multi-function, integrated sounder – duplicates the FACP sounder
3. LEDs for:
    a. Power (Green)
    b. Fire Alarm (Red)
    c. [Resident Unit/Dorm Room Smoke Detection / Priority 2 Alarm]
    d. Supervisory (Amber or Orange) [May also be used for Resident Unit/Dorm Room Smoke Detection]
    e. Trouble (Yellow)
4. Secured Switches (Secured under keyed door, or enabled via key switch) for:
    a. Acknowledge
    b. Signal Silence
    c. System Reset

EVAC SUB-SYSTEM FEATURES

In addition to the Annunciation features listed above the FAAP panel shall incorporate additional features - for control of the EVAC sub-system.

The additional features included in these panels shall be as follows:

1. A Microphone
2. Audio Control Switches identical to those found in the FACP.
3. Audio Status LEDs identical to those found in the FACP
4. A locked panel access door. This door shall include a viewing port, which shall allow the LCD Display, and all indicator LEDs to be seen, without need to open the door. The door shall be secured by means of a key, which shall be identical to the key used to gain access to the FACP enclosure. When the panel access door is unlocked, trained personnel shall be able to access the Microphone and any other required Operator Interface Switches.

GENERAL REQUIREMENTS
[FAAP] shall incorporate the following features:
Mar-resistant painted enamel or a stainless steel finish.

[FAAP] Panel shall communicate with the Fire Alarm Control Panel by means of a supervised serial data link, as well as any required audio buss connections. The operating power shall be 24VDC and shall be fused at the control panel. LED annunciators and point-wired (non-serial) annunciators are not considered equal and shall be unacceptable.

All wiring between the [FAAP] panel and the fire alarm control panel shall be supervised for opens, grounds and shorts.

Under normal operating conditions, the LCD display shall indicate the time, date and "SYSTEM IS NORMAL" label.

During abnormal conditions, the LCD shall operate in the same manner as the FACP LCD Display.

MULTIPLEX/INTELLIGENT PERIPHERAL DEVICES
All devices shall be supervised for trouble conditions. The system control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Failure of a device shall not hinder the operation of other system devices.

DEVICE IDENTIFICATION
Each intelligent device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address shall not be acceptable.

Device addressing schemes which use permanently-imbedded, electronically-identifiable “serial number” which is similar to the address imbedded within Personal Computer Network Interface Cards shall be acceptable.

Fire Alarm Systems utilizing hand-held or briefcase-style programming tools. Which are used to electronically assign addresses and/or programming parameters to devices shall

be acceptable. However one such programmer tool shall be provided to the Owner at no additional cost.

The address along with the loop number and end-of-line device if present shall be indicated, and be visible from the ground, on the device in the field using machine generated marking. Contractor shall provide a sample of such labeling scheme before using it.

End-of Line devices shall also be identified by means of permanent, machine generated label, affixed to the device.

Device identification schemes that do not use uniquely set addresses but rely on electrical position along the communication channel are unacceptable. These systems cannot accommodate t tapping and the addition of an intelligent device between existing devices requires re-programming all existing devices beyond added device.

The system must verify that proper type device is in place and matches the desired software configuration.

INTELLIGENT DETECTORS - GENERAL
Smoke and heat detectors must be approved by the state engineer prior to installation.

Each detector shall incorporate the following features:

1. LED(s), which shall flash to indicate communication with the Fire Alarm System, and which also illuminate in a steady manner when the detector is in an alarm status.
2. A means to allow field function testing of the detector.
3. A low-profile design / shape.
4. An insect screen.
5. Voltage and RF transient suppression techniques, in order to minimize false alarms.

Smoke detectors shall communicate the actual smoke chamber values to the system control panel.

Smoke detectors shall be listed for sensitivity testing from the control panel. Sensitivity test results shall be logged and downloaded to a printer.

The detectors shall be plug-in units, which mount to a common base, and shall be UL 268 approved.

Each detector shall be compatible with the fire alarm panel and shall obtain its operating power from the SLC, to which it is connected. (Where relay or sounder-equipped bases are used, it shall be acceptable to require a separate 24 VDC or NAC connection.) Each detector shall be reset by actuating the control panel reset switch.

If field conditions so require the smoke detection devices shall not be installed until the construction is completed.

INTELLIGENT DETECTOR BASES
Bases shall be suitable for either smoke or heat detector mounting.

Either the base or the head shall contain electronic circuits that communicate the detector's status (normal, alarm, sensitivity status, trouble, etc.) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Contacts between the base and head shall be of the bifurcated type using spring-type, self-wiping contacts.

The base shall be lockable. The locking feature must be field-removable when not required.

Upon removal of the detector's head, a trouble signal shall be transmitted to the control panel.

The detector base shall be sealed against rear airflow entry.

Each detector's base or head shall contain LED(s), which shall flash when the detector is being scanned by the control panel. The LED(s) shall turn on steady when the detector is in an alarm condition.

INTELLIGENT PHOTOELECTRIC SMOKE DETECTORS
The detectors shall contain no radioactive material.

Detectors shall be of the solid state photoelectric type and shall operate on the light scattering photodiode principle using a pulsed infrared LED light.

INTELLIGENT THERMAL DETECTORS
The detectors shall be a combination rate-of-rise and fixed temperature 135 F unless noted.

Detectors shall sense within a temperature range of 32 F to 158 F. The control panel shall be capable of sensing either a set point of 135 F, or a rate-of-rise of [15] or [20] degrees F per minute for fire sensing.

INTELLIGENT DUCT SMOKE DETECTORS
Duct detectors shall be of the photoelectric type specified above. It shall be possible to alarm the duct detector by using a remote or local test switch.

For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover.

Detector shall include remote keyed test switch and alarm LED indicator.

In mechanical rooms, alarm LED indicators for duct detectors shall be grouped on a stainless steel cover plate mounted adjacent to the main mechanical room door. Each LED shall be labeled with the detectors loop and address. A floor plan of the room showing the detectors and addresses shall be located adjacent to the cover plate. Provide Plexiglas cover over the plan.

ADDRESSABLE PULL STATIONS
Pull stations shall contain circuits that communicate the station's status (alarm, normal or trouble) to the control panel over two wires, which also provide power to the pull station. The address shall be field programmable on the station.

Manual stations shall be [single-action] [double-action] type, constructed of metal or of high impact, red Lexan with raised white lettering and a smooth high gloss finish.

Station shall mechanically latch upon operation and remain so until manually reset by means of a key common to all system locks. Stations that require Allen wrenches or special tools to reset them will not be accepted.

Manual stations shall be fitted with screw terminals or wire leads for field wire attachment.

INTERFACE MODULES - GENERAL
If external power to Addressable Interface Modules is required, such power shall be 24VDC, and shall be derived from a supervised fire alarm power supply.

Addressable Interface Modules may be provided in either a Class B or Class A supervision version.

In the Class B version the wiring shall be supervised by an end-of-line device.

In the Class A version the wiring shall be looped back and connected to the module to allow continual operation of the controlled devices even if the wiring sustains a single break.

The interface modules shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions.

INTERFACE MODULES - SUPERVISED CONTROL
Supervised Control Modules shall be utilized where needed, for control of Notification Appliances.

For Notification Appliances, speakers, and other device control with Class B or Class A wiring supervision, the interface module shall provide a double-pole/double-throw relay output, with supervision.

These interface modules shall communicate the supervised wiring status (normal, trouble) to the fire alarm control panel and shall receive from the fire alarm control panel a command to transfer the relay.

INTERFACE MODULES - SUPERVISED MONITORING
Addressable Monitor Modules shall be suited for monitoring of water-flow, valve tamper, Fire Suppression Control Panels, and other non-intelligent detectors and systems.

Addressable Monitor Modules shall be provided in any needed configuration, and may be used to interface any of the following initiation devices to a Signaling Line Circuit, as follows:

Conventional 2-wire smoke detectors, including providing suitable power to the IDC.

Normally Open, dry contact type devices - with class B or class A wiring supervision:
These interface modules shall communicate the Initiating Device Circuit status (normal, alarm, trouble) to the control panel.

INTERFACE MODULES - NON-SUPERVISED CONTROL
This interface module shall provide double-pole/double-throw relay switching for loads up to 120VAC. It shall contain easily replaceable 2 amp fuses, one on each common leg of the relay.

FAULT ISOLATOR MODULE (FIM)
The system shall employ Fault Isolator Modules (FIM) on the Signaling Line Circuits. These FIM units shall be utilized in order to isolate portions of SLCs, in the event of short circuit conditions. The SLC segment protected by each FIM shall be separated from the SLC in a manner such that a single short-circuit condition may not affect more than 25 Addressable Field Devices / Detectors, which are served by the isolated SLC segment.

The FIM shall be located as close as practical to the point where the isolated SLC sub-circuit branches, and shall also be located at an accessible location.

CONVENTIONAL PERIPHERAL DEVICES
NON-ADDRESSABLE HEAT DETECTORS
Non-Addressable Heat Detectors shall of the fixed temp type and only to be used at locations where the ambient conditions are unsuitable for Analog Addressable units, or where the required operation (set point / response index, etc.) cannot be achieved with Analog Addressable units. Where used, these devices shall be UL listed for their intended purpose. These heat detectors do not have to be made by the same manufacturer supplying the other fire alarm equipment for the project.

PROJECTED BEAM TYPE SMOKE DETECTORS
The Projected Beam Type Smoke Detectors shall be listed per UL 268 and shall functionally interface to the FACP as a standard, 4-wire type smoke detector.

The Projected Beam Type Smoke Detectors shall incorporate built-in "aiming-aid" features, such as optical sights or indicator LEDs. Where additional wiring or particular configurations are recommended by the manufacturer, in order to take advantage of built-in aiming features, such wiring or configurations shall be provided.

Installation methods utilized with these units shall be in strict compliance with the manufacturer's instructions.

A Remote Test Station shall be supplied for each TX / RX pair.

Power to each TX / RX pair shall be supervised, by means of either built-in Trouble relay outputs at each detector, or by means of end-of-line relays at each detector. Such Trouble Relay outputs and / or end-of line relays shall be connected to the IDC which monitors each TX / RX pair in a manner, such that Trouble conditions indicated by such relays / outputs do not prevent the transmission of an Alarm over the IDC.

Each TX / RX pair shall be individually monitored for Alarm status conditions, via addressable Monitor Modules, or via dedicated IDC circuits.

Each TX / RX pair shall be individually monitored for Trouble status conditions.

AUDIO VISUAL NOTIFICATION APPLIANCES
SPEAKERS
Speakers shall have a metal or Lexan housing with field adjustable output taps ranging from 1/8 watt to 2 watts. Speakers selected for this project shall produce a Sound Pressure Level, at the 1 watt tap of at least 87 dBA at 10 feet – as tested per UL Standard 1480. Speakers shall have vandal resistant Lexan or metal grilles and shall be have sealed backs to protect the phenolic impregnated cone.

HORNS
All horns shall be polarized, and shall be compatible with the 24 VDC NACs provided by the control panel and/or NAC Booster Panels/Supervised Control Modules. Each horn assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit.

Horns shall be UL listed to provide a minimum sound pressure level of 93 dB at 10 feet, per UL Standard 464.]

STROBES
ALL strobes, and the strobe portion of audible/strobe combination units, shall be of the Xenon type.

All strobes shall be designed for synchronized flash operation at one flash per second (1 Hz) minimum over the device's listed input voltage range. Strobes shall be synchronized such that all strobe units within the building shall flash simultaneously (As a minimum, all devices on each floor shall flash simultaneously, with flash timing within the limits established by current UL standards.).

PRINTERS AND TERMINALS
A printer shall be provided where shown on the plans.

PRINTER
A desktop 80-column, impact dot matrix printer shall provide a hard copy record of system events.
The printer shall receive English language text from the control panel in industry standard ASCII format via an EIA RS-232-C connection.

All printed information shall include time, date, status, point number, label, and the device type identifier. The printer shall have the following features:

1. 120 VAC input power.
2. 180 characters per second printing speed.
3. 3 kilobytes buffer capacity.
4. Cartridge type ribbon.
5. Friction feed for cut forms.
6. Tractor feed for continuous 9 1/2" wide pin-to-pin fanfold paper.
7. UL 864 listed (UOXX).

Contractor shall supply one box of 2,300 (minimum) continuous-feed Sheets, 9 1/2" x 11", 20 Lb., Clean Edge, White Bond computer paper suitable for use the supplied printer.

TERMINAL
A desktop terminal unit shall be provided. This terminal shall serve as an auxiliary annunciator, and as a convenient user interface for maintenance purposes. The screen may be LCD or VDT type. This terminal shall incorporate a full-size keyboard, which will permit efficient entry of commands, etc. When the terminal is not in use, the keyboard shall be detached and secured.

Contractor shall supply a dust-proof cabinet with a see-through front cover to house the terminal and printer.

[An acceptable alternative to the terminal shall be terminal emulation software, and a 6-foot cable – suitable for connection of a laptop PC to a non-supervised port, within the FACP.]

SPECIAL DEVICES
TOOLS/KEYS
Contractor shall provide two keys per pull station. Keys shall be identical and usable in all keyways associated with this project – including, but not limited to Manual Pull Stations, the FACP, [and FAAP] [and RFCC] Panel(s).

Provide one device programmer tool for fire alarm systems utilizing hand-held or briefcase-style programming tools used to electronically assign addressees and/or programming parameters.

PART 3 - EXECUTION

GENERAL
The complete installation shall be done in a neat, workmanlike manner in accordance to the applicable requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.

Smoke detectors shall not be mounted until the construction is completed, unless they are covered with plastic bags or fitted covers immediately after installation to maintain cleanliness.

RACEWAYS
NOTE: ALL FIRE ALARM SYSTEM WIRING SHALL BE INSTALLED WITHIN METALLIC CONDUIT UNLESS SPECIFIED.

All wiring shall be in a conduit system separate from other building wiring. See Section 26 05 33 – Raceway and Boxes for Electrical Systems for specifications.

All wiring shall be in minimum ½" steel raceway.

40% fill factor shall be applied to all conduit sizes.

The contractor shall size conduit and boxes by circular mil size of each cable in each conduit or box. The circular mil sizing can be found on the manufacture's spec sheet, then use the NEC codebook to make calculation to follow NEC Table 370-16(a) for box fill and Chapter 9 for conduit fill.

There shall be no sharp edges with installed materials.

Use only identified conduit entries or request approval for other penetrations in cabinets; (certain areas require clear space for interior components / batteries). Cabinet shall be grounded to either a cold water pipe or grounding rod.

Existing conduit and surface metal raceway that is ½" in size or larger may be reused if found to have adequate space provided that it only serves the Fire Alarm system and doesn't contain any AC wiring. All existing conduit that is reused MUST be brought up to the current State of Wisconsin Electrical Code and Approved for usage by the engineer prior to work being done.

CONDUCTORS

All wire and cable associated with this system shall be as required by the equipment manufacturer. The following information is intended for estimating purposes only. However, the minimum wire gauges and colors specified shall be strictly adhered to. All cable shall be installed as per NEC Article 760.

Type FPL wiring is required if the system is run in conduit or 'free-air.

All initiation and notification circuit cabling shall be listed Type FPL (300V) in accordance to NEC article 760."

All cables and wires #14 AWG and larger shall be stranded.

Fire alarm wiring shall be held in place at the device box, by means of a two-screw connector, (do not use squeeze or crimp type connectors).

All wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, disarrangement of any components, any open circuits or grounds in the system, an audible and visual trouble signal shall be activated until the system is restored to normal.

All conductors shall be color-coded. Coding shall be consistent throughout the facility. Green wire shall be used only for equipment ground.

Each Fire Alarm Control Panel, [Annunciator Panel], [and Remote Fire Command Center] shall be connected to separate dedicated branch circuit from the building emergency panel, maximum 20 amperes. Circuit shall be labeled as "FIRE ALARM". The breaker shall be painted red and cap-locked.

Power wiring for Fire Alarm Control Panel, [Annunciator Panel], [and Remote Fire Command Center] shall be #12 AWG.

Fire Alarm Control Panel, [Annunciator Panel], [and Remote Fire Command Center] shall have #6 AWG green equipment ground wire.

Fire alarm risers, notification appliance circuits and interconnections to remote panels (per NFPA 72) shall have a minimum 2Hr fire alarm rating. All notification appliance circuits shall be protected from the fire alarm panel of origination to the signaling zone they serve.

Where fire alarm circuits enter or leave a building, additional transient 75 to 90 volt gas tube protection shall be provided for each conductor.

Leave 8-inch wire tails at each device box and 36-inch wire tails at the Fire Alarm Control Panel [and Remote Annunciator Panel(s)], [and Remote Fire Command Center].

Cable for Intelligent detector Loops shall be 18 to 12 AWG twisted pair with a shield jacket installed in ½" conduit. Shield continuity must be maintained and connected to earth ground only at the control panel.

SLC wiring must not be in the same conduit with AC power wiring or other high current circuits. T-taps or branch circuit connections are allowed for all class B SLCs.

Cable for RS 232-c devices (CRT, PRINTER) shall be dual pair twisted- shielded.

Cable for RS 485 devices (Remote Annunciators) shall be twisted-shielded pair (Belden 9841 or equivalent) for the data signal. Power wiring shall be 12 AWG.

All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and labeled "FIRE ALARM SYSTEM" or “FA” by decal or other approved markings.

Speaker and strobe circuits shall have separate conductors, and shall operate independently of each other.

[Mini horn wiring shall be #14 AWG minimum.]

Speaker wiring shall be #18 AWG twisted-shielded cable.

Strobe wiring shall be #14 AWG minimum.

Tray cable is not acceptable for use as fire alarm system wiring installed in conduit.

DEVICE MOUNTING

Unless otherwise noted on the drawings, plans, specifications or by the Architect or engineer; the recommended mounting heights, and requirements are as follows:

FIRE ALARM CONTROL PANELS

Mount control panels such that all visual indicators and controls are located at 60 inches above floor level.

ANNUNCIATOR/REMOTE FIRE COMMAND CENTER PANELS
Mount FAAP/RFCC panels such that all visual indicators and controls are located at 60 inches above floor level.

VISUAL AND AUDIO / VISUAL NOTIFICATION APPLIANCES
In Public-Mode Areas, as defined within NFPA-72, install flush, semi-flush or surface between 80 inches and 96 inches or 6 inches below finished ceiling or at 80 inches from the bottom of the device to the highest level of the finished floor. No devices protruding 4 inches or more shall be installed lower than 80 inches. If these requirements are not achievable, consult with the engineer before installation.

Audio/visual devices may be installed on the ceilings only where indicated, or where approved in writing by the engineer. (In such cases, these devices shall be installed in accordance to current NFPA 72 standards).

Except as noted in the previous paragraph, all audio/visual devices shall be installed at the same height throughout the facility.

For surface mounting, use manufacture-supplied backboxes and trim plates, which shall be painted Red or off White, and shall contain no visible conduit knock-outs. Mark each device with its circuit number.

MANUAL STATIONS
The operable part of the manual stations shall be installed not less than 3 ½ feet (42") and not more than 4 feet (48”) above finished floor. All Manual Stations shall be in unobstructed locations. Mark the unit’s address on the inside and outside of housing.

All manual pull stations shall be installed at the same height throughout the facility.

For surface mounting, use manufacture-supplied backboxes and trim plates. Backboxes shall be painted Red or off White, and shall contain no visible conduit knock-outs. Mark each device with its loop and address.

During the installation of the new fire alarm systems, new pull stations should be covered or identified as not being operable so building occupants will not be confused as to which fire alarm pull station should be pulled during an alarm condition. Likewise, after the new system is installed, tested and accepted, the existing pull stations should be identified as not being operable (or permanently removed as soon as possible).

HEAT AND SMOKE DETECTORS
The location of detectors shown on the plans is schematic only. The detectors must be located according to code requirements.

Surface mounted detectors shall be installed using back boxes equal to the base's size. Standard octagon and square boxes are not acceptable.

Detectors should be located on the highest part of a smooth ceiling so that the edge of the detector is no closer than 4 inches from a sidewall. Ceilings with beams, joists or soffits that exceed 8 inches in depth require special planning and closer spacing.

If it is necessary to mount a detector upon a sidewall, the top of the detector (the sensing chamber portion of the device) shall be located no closer than 4 inches from the ceiling and no further away than 12 inches.

Smoke detectors should be installed to favor the air flow towards return openings and not located closer than 3 feet from air supply diffusers which could dilute smoke before it reaches the detector. No detectors shall be installed in direct airflow.

Duct smoke detector installation to be by this contractor and should be installed in the locations shown on the mechanical and electrical plans. Ensure that the duct smoke detectors are in serviceable locations. Consult with the mechanical designer for alternate locations if these are shown in non-serviceable locations. When locations on mechanical plans are not available, install in locations called for that provide accessibility for service. Do not install within four feet of a fan discharge

Heat and smoke detectors should be located near the center of the open area which they are protecting, thus providing coverage generally for 15-foot radius for heat and smoke detectors. Questionable locations shall be verified with Architect or engineer before installation takes place.

Heat and smoke detectors / Sensors – both Intelligent and non-addressable, shall be installed in accordance to their UL Listed Spacing. The quantity of Heat and smoke detectors / Sensors depicted on the drawings is based on the 900 square foot per detector rule. If detectors with significantly different spacing requirements are selected by the Fire Alarm equipment provider / EC, then additional detectors / sensors, if required, shall be provided at no additional cost to the project.

IDENTIFICATION

Attach the label containing the address and SLC designation to:

1. Each addressable detector. Label shall be visible and readable from the floor, 3/16" minimum character size (¼" is recommended).
2. Each manual pull station. Label shall be placed on the top part.
3. Each Addressable Module. Label shall be attached to the faceplate.

Label shall consist of black writing on white or clear background.

All junction boxes shall be painted red and labeled "Fire Alarm" or "FA".

All circuits must be labeled with the name of circuit and the area being served by the circuit.

Wire/cable splices in junction boxes shall be labeled indicating where the wire/cable is coming from and where it is going.

All conductors terminated in control panels, annunciator panels and extension panels shall be labeled.

All audio visual devices shall be labeled by each circuit and the order of the device on that circuit such as “Circuit No. 2, strobe No. 05 of 10”.

All labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED. Submit a sample for approval before using any labeling schemes.

Label size shall be appropriate for the conductor or cable size(s) and design. All labels to be used shall be self-laminating, white/transparent vinyl and be wrapped around the cable (sheath). 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.

Adhesive type labels not permitted except for phase and wire identification.

TESTING

Before proceeding with any testing, all persons, facilities and building occupants whom receive alarms or trouble signals shall be notified by the contractor to prevent unnecessary response or building occupant distress. At the conclusion of testing, those previously notified shall be notified that testing has been concluded.

The manufacturer's authorized representative shall provide on-site supervision of installation of the complete fire alarm system installation, perform a complete functional test of the system, and submit a written report to the contractor attesting to the proper operation of the completed system prior to final inspection.

Contractor shall pre-test each and every device in the system before the system is considered ready for final inspection.

The completed and pre-tested fire alarm system shall be fully tested in accordance to NFPA-72 by the contractor in the presence of the engineer, DSF representative, Owner's representative and the local Fire Marshal.

The engineer or his authorized representative may suspend or discontinue the tests at any time performance is considered unsatisfactory. Resumption of testing will cover untested elements and any replaced elements. The contractor shall furnish all test personnel, test

instruments and equipment of the accuracy necessary to perform the test. Arrangements for testing must be made with the DSF representative and the engineer at least two weeks before the proposed testing date.

Upon the completion of a successful test, and prior to the final request for payment the contractor shall:

1. Certify the system to the Owner in writing
2. Complete the NFPA 72 record of completion form
3. Provide as-builts and O&M manuals.
4. Provide a signed statement that the Owner had received the specified system operation and maintenance training

The final payment will not be processed unless these documents are complete and are on hand.

WARRANTY

The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of two years from the date of substantial completion of the project.

At the end of the project, the contractor shall post the warranty period along with the company's name and telephone number inside the fire alarm panel.

Any occupied facility shall not be without a UL and an NFPA approved and fully operational fire alarm system for a period longer than 2 hours. Emergency response shall be provided within 2 hours of the notification, to the contractor, of the failure of the system to perform operationally per UL and NFPA standards. Non-emergency service calls shall be responded to within 24 hours of the notification to the contractor.

Emergency situations may include, but not limited to

1. System can't be acknowledged or reset.
2. System is non-responsive to commands.
3. System in non-responsive to actuated alarm devices.
4. Malfunction of notification/initiating circuit(s).
5. System going into alarm/trouble without indicating the source.
6. System is dead (no power), etc.

Repairs and/or replacement arising from emergency situations shall be completed within 24 hours of the time of notification. Other than emergency, actual repairs and /or replacement shall be provided within 72 hours of the time of notification during normal working hours, Monday through Friday, excluding holidays. If the repairs involve parts that are not shelve items and require lead time, the contractor shall inform the Owner within 24 hours from the time of notification of the exact time when the repairs will be completed.

If repair and/or replacement cannot be made within the prescribed time, then other means and methods of protection shall be provided to ensure the safety of the building's occupants during which time the system is not in compliance with the standards. This may involve up to and include hiring Owner approved qualified personnel to stand a fire watch, all at the contractor's expense.

Warranty service for the equipment shall be provided by the system supplier's factory trained representative. Further, Warranty shall include all parts, labor and necessary travel.

TRAINING

The contractor through his/her supplier shall provide, as part of this contract, a minimum of 6 hours system operation training for owner, the Architect/Engineer, and fire department personnel. The training session shall consist of the following sessions:

Two 3-hour sessions for the purpose of training personnel who will need to operate the system – primarily, Level 1 and Level 2 system operators / users.

All training sessions shall be coordinated and scheduled by the EC, and shall be conducted at a time to be stipulated by the owner. All training and other indoctrination shall be completed prior to final inspection.

The contractor shall videotape all training and instructional sessions on DVD. Provide a separate DVD for each system and label for the system demonstrated and turnover to the Owner.

Training shall not take place until all systems are 100% operational as determined by the Owner. The purpose of training is to fully prepare the facility maintenance staff for complete operational responsibility of the fire alarm system.

The facility maintenance staff shall be fully trained and be given the capability by the product Vendor and installing contractor to modify, to program, to fully repair, to service, and to maintain the system after (and if desired, during) the warranty period.

The above training shall include, but not be limited to, providing and reviewing all programming software, access codes, and licenses that allow the Owner to add or to delete any points (i.e.: The mapping of devices), and to change a heat detector to a smoke detector. To meet this requirement, provide the necessary configuration and/or access code (hardware and/or software key). If the Vendor cannot meet this requirement, the product is not acceptable

SPECIAL CONSIDERATIONS
Contractor shall refer to Division 1, General Requirements, "SPECIAL SITE CONDITIONS"

End of Section 28 31 00

END OF DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

61. Project Concrete Crack Mitigation and Repair Special, Item SPV.0105.18.

A Description
This special provision describes work in accordance to standard spec 415, and as hereinafter provided.

B (Vacant)

C Construction
Provide the engineer with HIPERPAV analysis 3 days prior to the placement of Concrete Pavement 9-Inch Special. If 7 calendar days elapse between staging paving operations, an additional analysis of HIPERPAV may be requested by the engineer.

If cracks occur, selection of repair type shall be as specified in Procedure 4.24 of the Construction and Materials Manual (CMM).

D Measurement
The department will measure Project Concrete Crack Mitigation and Repair Special by the lump sum unit of work, acceptably completed.

E Payment
Delete entire standard spec 415.5.3 and replace with the following:

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.01	Project Concrete Crack Mitigation and Repair Special	LS

Payment is full compensation for performing mix design HIPERPAV analysis, mix design adjustments and corrections as per Project Concrete Crack Mitigation and Repair Special, all PCC pavement repairs, mobilization, all necessary traffic control devices.

Fifty percent payment of this item will be paid to the contractor after the completion of the first HIPERPAV analysis. The remaining fifty percent will be paid for upon final project acceptance.

62. Construction Staking Concrete Pavement Joint Layout, Item SPV.0105.19.

A Description
This work shall consist of staking the location of all joints on the project, including mainline and intersections to accommodate the concrete paving operation. The contractor shall set all points necessary to establish the horizontal position of the dowel bar sets and saw joints in the concrete pavement in accordance to the plans or as directed by the engineer.

B (Vacant)

C Construction
Plan and locate all points necessary to establish the horizontal position of the transverse and longitudinal joints in the concrete to prevent uncontrolled cracking. Mark the location of all concrete joints in the field. Make joint adjustments as required to fit field conditions, traffic staging, or as directed by the engineer.

The concrete pavement maximum joint spacing is 15 feet as shown in the Standard Detail Drawings unless otherwise approved by the engineer.

D Measurement
The department will measure Construction Staking Concrete Pavement Joint Layout as a single lump sum unit, 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.0105.19	Construction Staking Concrete Pavement Joint Layout	LS

Payment is full compensation for survey work necessary to locate all dowel bar sets and saw joints on the mainline and intersections, for adjustments to match field conditions and traffic staging.

63. Concrete Pavement 10-Inch Colored, Item SPV.0180.01.

A Description
This special provision describes constructing colored concrete pavement, in accordance to standard spec 405 and standard spec 415, as shown on the plans, and hereinafter provided.

B (Vacant)

C (Vacant)

D Measurement
The department will measure Concrete Pavement 10-Inch Colored in square yards of surface area, acceptably completed.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0180.01	Concrete Pavement 10-Inch Colored	SY

Payment is full compensation for preparing the foundation; for furnishing, hauling, preparing, coloring, placing, curing, and protecting the concrete: for jointing and joint materials, dowels, and tie bars; for measuring opening strength including fabricating and testing cylinders, obtaining and testing cores, and evaluating maturity; for measuring pavement thickness, except as specified in standard spec 415.3.18.7; and for filling all core holes, and incidentals necessary to complete the contract work.

64. Scale Approach Pavement Reinforcement, Item SPV.0180.02.

A Description
This special provision describes furnishing and installing continuous reinforcement for concrete pavement, in accordance to standard spec 415, as shown on the plans, and hereinafter provided.

B Materials
Furnish steel reinforcement conforming to standard spec 505. Furnish dowel bars and tie bars as the plans show and conforming to standard spec 505.2.6.

C Construction
Reinforce the concrete pavement if and as the plans specify. Keep reinforcement clean and free from rust scale, straight and free from distortion. Store all reinforcement steel, received on the job, in engineer-approved storage and distribute only as needed for immediate placement.

Placing Continuous Pavement Reinforcement:

1. Place the bar steel reinforcement after properly preparing the subgrade. Place the longitudinal bars on top of the transverse bars and firmly tie or fasten together at each intersection. Support the assembled bars on bar chairs at a depth the plans show. Bar chairs are subject to the engineer's approval. They shall be sufficient in strength and number to hold the steel reinforcement in position during construction.
2. Splice longitudinal bars by lapping, as the plans show, and firmly tie or fasten together. Arrange splices as the plans show. Install additional steel reinforcement, as the plans show at construction joints.

3. Protect all bar steel reinforcement left protruding from the slab for any extended period from deterioration caused by exposure.
4. Do not bend bar steel reinforcement or subject to loading or forces that distort the steel or weaken the bond to the concrete.
5. Tie coated bars using a procedure, equipment, and materials that do not damage or cut the coating. Use one or more of the following materials to tie coated bars:
   a. Engineer-approved plastic or nonmetallic material.
   b. Stainless steel wire.
   c. Nylon, epoxy, or plastic-coated wire

D Measurement

The department will measure Scale Approach Pavement Reinforcement, composed of steel bars, by the square yard of concrete pavement with reinforcement incorporated and acceptably completed. The department will not deduct the areas for clearances called for adjacent to the edges of the slab or joints.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0180.02	Scale Approach Pavement Reinforcement	SY

Payment is full compensation for furnishing and installing reinforcement and for coating.

Concrete Pavement 11-inch will be paid for under a separate bid item.

65. Parking Lot Island Surface, Item SPV.0180.03.

A Description

This special provision describes salvaging, furnishing and installing landscape surfacing consisting of salvaged concrete slabs and trap rock as shown in the plans and as hereinafter provided.

B Materials

Salvage the required concrete pavement or sidewalk slabs from the existing weigh station site located adjacent to the new SWEF site. The contractor may supply the concrete slabs from other sources at his/her discretion. Concrete slabs shall be roughly 4-25 square feet in size.

Trap rock shall consist of crushed dark, fine-grained igneous rock, bluish-gray basalt, 1-¼ - 1-½ inch in size. Incorporate rock that is hard, sound, and durable, and meets the approval of the engineer.

C Construction
Install concrete slabs on a plane one inch above the plane created by the surrounding top of curbs. Slabs shall cover approximately 50% of the area designated on the plan. If the bottoms (rough side) of slabs are relatively uniform, turn the rough sides of some, or all, up as determined by the engineer. Install grass plants according to the plans and cross-section 3/L201 so they occupy the largest interstices and are somewhat uniformly spaced. Place grass plants with tops of pots on a plane with the top of slabs.

D Measurement
The department will measure Parking Lot Island Surface in area by the square yard of material, acceptably completed.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0180.03	Parking Lot Island Surface	SY

Payment is full compensation for furnishing, producing, crushing, loading, hauling, placing concrete slabs and trap rock and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

Furnishing and installing grass plants will be paid for under separate bid items.

66. Salvage Topsoil at New Facility, Item SPV.0180.04.

A Description
This special provision describes methods for salvaging topsoil according to standard spec 625 for the new SWEF #72, in preparation for use within the wetland restoration area.

Amend standard spec 625.1 (2) with the following:

This section also describes removing topsoil from the sites of proposed excavations within the new SWEF #72 area in amounts and depths available and necessary to cover the wetland restoration area to a depth of approximately 8 inches.

B (Vacant)

C Construction

Amend standard spec 625.3.3 with the following:

Stockpile the salvaged topsoil to the location specified in the plan. Seed the stockpile with a nurse crop of Annual Oats (*Avena sativa*) at a rate of 5 lbs per 1,000 square feet. Complete temporary seeding within two days after stockpile is complete.

D Measurement
The department will measure Salvage Topsoil at New Facility by the square yard, 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.0180.04	Salvage Topsoil at New Facility	SY

Payment is full compensation for excavating this material to the depths described above and stockpiling this material.

Seeding Nurse Crop will be paid for under a separate bid item.

67. Placing Topsoil at Wetland Restoration, Item SPV.0180.05.

A Description
This special provision describes methods for placing previously salvaged stockpiled material within the wetland restoration area, according to standard spec 625 and as hereinafter provided.

B (Vacant)

C Construction
Amend standard spec 625.3.3 with the following:

Construct restoration site to the lines and grades as shown on the plans and as modified by the Wetland Biologist Monitor. Furnish the appropriate equipment to shape and finish the restoration site as directed by the Wetland Biologist Monitor.

D Measurement
The department will measure Placing Topsoil at Wetland Restoration by the square yard, 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.0180.05	Placing Topsoil at Wetland Restoration	SY

Payment is full compensation for placing previously salvaged topsoil necessary to restore and complete the restoration site to the final contours, as directed by the Wetland Biologist Monitor.

68. Mulching Certified Weed-Free, Item SPV.0180.06.

A Description

This special provision describes placing mulch according to standard spec 627 and as hereinafter provided.

B Materials

Mulching material consists of straw or hay in an air-dry condition, wood excelsior fiber, or other certified material of a similar nature that the engineer approves, and shall be certified as noxious weed seed free forage and mulch, according to Wisconsin Department of Transportation requirements and the standards of the North American Weed Free Forage Certification Program by the Wisconsin Crop Improvement Association (WCIA) or crop certification agencies in adjoining states. A certification tag from the certifying agency indicating that the mulching material meets department standards shall be attached to each bale delivered to the site.

C Construction

Mulching shall not take place in flooded areas.

Replace standard spec 627.3.2 with the following.

Perform the work using Method B. Tackifier

D Measurement

The department will measure Mulching Certified Weed-Free in area by the square yard, acceptably completed.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0180.06	Mulching Certified Weed-Free	SY

Payment is full compensation for providing all materials, for furnishing all hauling, treating, placing, spreading, and anchoring of the mulch material; for maintaining the work and repairing all damaged areas.

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 $2.90 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:

$$FA = \left(\frac{CFI}{BFI} - 1 \right) x\ Q\ x\ BFI$$

(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 2014 edition of the standard specifications:

101.3 Definitions

Replace the definition of semi-final estimate with the following effective with the December 2013 letting:

Semi-final estimate An estimate indicating the engineer has measured and reported all contract quantities and materials requirements.

105.11.1 Partial Acceptance

Replace paragraph two with the following effective with the December 2013 letting:

(2) Partial acceptance will relieve the contractor of maintenance responsibility for the designated portion of the work. By relieving the contractor of maintenance, the department does not relieve the contractor of responsibility for defective work or damages caused by the contractor's operations. Do not construe partial acceptance to be conditional final acceptance or final acceptance of any part of the project, or a waiver of any legal rights specified under 107.16.

105.11.2 Final Acceptance

Retitle and replace the entire text with the following effective with the December 2013 letting:

105.11.2 Project Acceptance

105.11.2.1 Inspection

105.11.2.1.1 General

(1) Notify the engineer when the project is substantially complete as defined in 105.11.2.1.3. As soon as it is practical, the engineer will inspect the work and categorize it as one of the following:

1. Unacceptable or not complete.
2. Substantially complete.
3. Complete.

105.11.2.1.2 Unacceptable or Not Complete

(1) The engineer will identify, in writing, work that is unacceptable or not complete. Immediately correct or complete that work. The engineer will assess contract time until the work is corrected or completed.

(2) Proceed as specified in 105.11.2.1.1 until the engineer determines that the work is complete.

105.11.2.1.3 Substantially Complete

(1) The project is substantially complete and the engineer will no longer assess contract time if the contractor has completed all contract bid items and change order work, except for the punch-list. As applicable, the following must have occurred:

1. All lanes of traffic are open on a finished surface.
2. All signage and traffic control devices are in place and operating.
3. All drainage, erosion control, excavation, and embankments are completed.
4. All safety appurtenances are completed.

(2) The engineer will provide a written punch-list enumerating work the contractor must perform and documents the contractor must submit before the the engineer will categorize the work as complete.

1. Punch-list work includes uncompleted cleanup work required under 104.9 and minor corrective work. Immediately correct or complete the punch-list work. The engineer may restart contract time if the contractor does not complete the punch-list work within 5 business days after receiving the written punch-list. The engineer and contractor may mutually agree to extend this 5-day requirement.
2. Punch-list documents include whatever contract required documentation is missing. The engineer may restart contract time if the contractor does not submit the punch-list documents within 15 business days after receiving the written punch-list. The engineer and contractor may mutually agree to extend this 15-day requirement.

(3) Proceed as specified in 105.11.2.1.1 until the work is complete.

105.11.2.1.4 Complete

(1) The project is complete when the contractor has completed all contract bid items, change order work, and punch-list work including the submission of all missing documentation.

105.11.2.2 Conditional Final Acceptance

(1) When the engineer determines that the project is complete, the engineer will give the contractor written notice of conditional final acceptance relieving the contractor of maintenance responsibility for the completed work.

105.11.2.3 Final Acceptance

(1) The engineer will grant final acceptance of the project after determining that all contract is work complete; all contract, materials, and payroll records are reviewed and approved; and the semi-final estimate quantities are final under 109.7.

(2) Failure to discover defective work or materials before final acceptance does not prevent the department from rejecting that work or those materials later. The department may revoke final acceptance if the department discovers defective work or materials after it has accepted the work.

105.13.3 Submission of Claim

Replace paragraph one with the following effective with the December 2013 letting:

(1) Submit the claim to the project engineer as promptly as possible following the submission of the Notice of Claim, but not later than final acceptance of the project as specified in 105.11.2.3. If the contractor does not submit the claim before final acceptance of the project, the department will deny the claim.

107.17.3 Railroad Insurance Requirements

Replace paragraph one with the following effective with the December 2013 letting:

(1) If required by the special provisions, provide or arrange for a subcontractor to provide railroad protective liability insurance in addition to the types and limits of insurance required in 107.26. Keep railroad protective liability insurance coverage in force until completing all work, under or incidental to the contract, on the railroad right of way or premises of the railroad and until the engineer determines that the work is complete as specified in 105.11.2.1.4.

107.26 Standard Insurance Requirements

Replace paragraph one with the following effective with the December 2013 letting:

(1) Maintain the following types and limits of commercial insurance in force until the engineer determines that the work is complete as specified in 105.11.2.1.4.

TABLE 107-1 REQUIRED INSURANCE AND MINIMUM COVERAGES

TYPE OF INSURANCE	MINIMUM LIMITS REQUIRED[1]
1. Commercial general liability insurance endorsed to include blanket contractual liability coverage.[2]	$2 million combined single limits per occurrence with an annual aggregate limit of not less than $4 million.
2. Workers' compensation.	Statutory limits
3. Employers' liability insurance.	Bodily injury by accident: $100,000 each accident Bodily injury by disease: $500,000 each accident $100,000 each employee
4. Commercial automobile liability insurance covering all contractor-owned, non-owned, and hired vehicles used in carrying out the contract.[2]	$1 million-combined single limits per occurrence.

[1] The contractor may satisfy these requirements with primary insurance coverage or with excess/umbrella policies.

[2] The Wisconsin Department of Transportation, its officers, agents, and employees shall be named as an additional insured under the general liability and automobile liability insurance.

108.14 Terminating the Contractor's Responsibility

Replace paragraph one with the following effective with the December 2013 letting:

(1) The contractor's responsibilities are terminated, except as set forth in the contract bond and specified in 107.16, when the department grants final acceptance as specified in 105.11.2.3.

109.2 Scope of Payment

Replace paragraph two with the following effective with the December 2013 letting:

(2) The department will pay for the quantity of work acceptably completed and measured for payment as the measurement subsection for each bid item specifies. Within the contract provide means to furnish and install the work complete and in-place. Payment is full compensation for everything required to perform the work under the applicable bid items including, but not limited to, the work elements listed in the payment subsection. Payment also includes all of the following not specifically excluded in that payment subsection:

1. Furnishing and installing all materials as well as furnishing the labor, tools, supplies, equipment, and incidentals necessary to perform the work.
2. All losses or damages, except as specified in 107.14, arising from one or more of the following:
    - The nature of the work.
    - The action of the elements.
    - Unforeseen difficulties encountered during prosecution of the work.
3. All insurance costs, expenses, and risks connected with the prosecution of the work.
4. All expenses incurred because of an engineer-ordered suspension, except as specified in 104.2.2.3.
5. All infringements of patents, trademarks, or copyrights.
6. All other expenses incurred to complete and protect the work under the contract.

109.6.1 General

Replace paragraphs three and four with the following effective with the December 2013 letting:

(3) The department’s payment of an estimate before conditional final acceptance of the work does not constitute the department’s acceptance of the work, and does not relieve the contractor of responsibility for:

1. Protecting, repairing, correcting, or renewing the work.
2. Replacing all defects in the construction or in the materials used in the construction of the work under the contract, or responsibility for damage attributable to these defects.

(4) The contractor is responsible for all defects or damage that the engineer may discover on or before the engineer’s conditional final acceptance of the work. The engineer is the sole judge of these defects or damage, and the contractor is liable to the department for not correcting all defects or damage.

109.7 Acceptance and Final Payment

Replace paragraphs one and two with the following effective with the December 2013 letting:

(1) After the engineer grants conditional final acceptance of the work as specified in 105.11.2.2 and reviews required document submittals and materials test reports, the engineer will issue the semi-final estimate.

(2) Within 30 calendar days after receiving the semi-final estimate, submit to the engineer a written statement of agreement or disagreement with the semi-final estimate. For an acceptable statement of disagreement, submit an item-by-item list with reasons for each disagreement. If the contractor does not submit this written statement within those 30 days, the engineer will process the final estimate for payment. The engineer and the contractor can mutually agree to extend this 30-day submission requirement.

450.3.3 Maintaining the Work

Replace paragraph one with the following effective with the December 2013 letting:

(1) Protect and repair the prepared foundation, tack coat, base, paved traffic lanes, shoulders, and seal coat. Correct all rich or bleeding areas, breaks, raveled spots, or other nonconforming areas in the paved surface.

455.3.2.5 Maintaining Tack Coat

Replace paragraph one with the following effective with the December 2013 letting:

(1) Protect and repair the existing surface and the tack coat. Correct areas with excess or deficient tack material and any breaks, raveled spots, or other areas where bond might be affected.

460.2.2.3 Aggregate Gradation Master Range

Replace paragraph one with the following effective with the January 2014 letting:

(1) Ensure that the aggregate blend, including recycled material and mineral filler, conforms to the gradation requirements in table 460-1. The values listed are design limits; production values may exceed those limits.

TABLE 460-1 AGGREGATE GRADATION MASTER RANGE AND VMA REQUIREMENTS

SIEVE	PERCENTS PASSING DESIGNATED SIEVES						
	NOMINAL SIZE						
	37.5 mm	25.0 mm	19.0 mm	12.5 mm	9.5 mm	SMA 12.5 mm	SMA 9.5 mm
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 E-3 mixes.

[2] 15.5 for E-3 mixes.

460.2.7 HMA Mixture Design

Replace paragraph one with the following effective with the January 2014 letting:

(1) For each HMA mixture type used under the contract, develop and submit an asphaltic mixture design according to the department's test method number 1559 as described in CMM 8-66 and conforming to the requirements of table 460-1 and table 460-2. The values listed are design limits; production values may exceed those limits. The department will review mixture designs and report the results of that review to the designer according to the department's test method number 1559.

TABLE 460-2 MIXTURE REQUIREMENTS

Mixture type	E - 0.3	E - 1	E - 3	E - 10	E - 30	E - 30x	SMA
ESALs x 10^6 (20 yr design life)	< 0.3	0.3 - < 1	1 - < 3	3 - < 10	10 - < 30	>= 30	___
LA Wear (AASHTO T96)							
100 revolutions(max % loss)	13	13	13	13	13	13	13
500 revolutions(max % loss)	50	50	45	45	45	45	40
Soundness (AASHTO T104) (sodium sulfate, max % loss)	12	12	12	12	12	12	12
Freeze/Thaw (AASHTO T103) (specified counties, max % loss)	18	18	18	18	18	18	18
Fractured Faces (ASTM 5821) (one face/2 face, % by count)	60 / __	65 / __	75 / 60	85 / 80	98 / 90	100/100	100/90
Flat & Elongated (ASTM D4791) (max %, by weight)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	20 (3:1ratio)
Fine Aggregate Angularity (AASHTO T304, method A, min)	40	40	43	45	45	45	45
Sand Equivalency (AASHTO T176, min)	40	40	40	45	45	50	50
Gyratory Compaction							
Gyrations for N_{ini}	6	7	7	8	8	9	8
Gyrations for N_{des}	40	60	75	100	100	125	65
Gyrations for N_{max}	60	75	115	160	160	205	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)	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)
% G_{mm} N_{ini}	<= 91.5[1]	<= 90.5[1]	<= 89.0[1]	<= 89.0	<= 89.0	<= 89.0	___
% G_{mm} N_{max}	<= 98.0	<= 98.0	<= 98.0	<= 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	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 - 78[4]	65 - 75[3] [4]	65 - 75[3] [4]	65 - 75[3] [4]	65 - 75[3] [4]	70 - 80
Tensile Strength Ratio (TSR) (ASTM 4867)							
no antistripping additive	0.70	0.70	0.70	0.70	0.70	0.70	0.70
with antistripping additive	0.75	0.75	0.75	0.75	0.75	0.75	0.75
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 9.5mm and 12.5 mm nominal maximum size mixtures, the specified VFB range is 70 - 76%.

[4] For 37.5mm nominal maximum size mixes, the specified VFB lower limit is 67%.

[5] For 25.0mm nominal maximum size mixes, the specified VFB lower limit is 67%.

460.2.8.2.1.5 Control Limits

Replace paragraph one with the following effective with the January 2014 letting:

(1) Conform to the following control limits for the JMF and warning limits based on a running average of the last 4 data points:

ITEM	JMF LIMITS	WARNING LIMITS
Percent passing given sieve:		
37.5-mm	+/- 6.0	+/- 4.5
25.0-mm	+/- 6.0	+/- 4.5
19.0-mm	+/- 5.5	+/- 4.0
12.5-mm	+/- 5.5	+/- 4.0
9.5-mm	+/- 5.5	+/- 4.0
2.36-mm	+/- 5.0	+/- 4.0
75-µm	+/- 2.0	+/- 1.5
Asphaltic content in percent	- 0.3	- 0.2
Air voids in percent	+/- 1.3	+/- 1.0
VMA in percent[1]	- 0.5	- 0.2

[1] VMA limits based on minimum requirement for mix design nominal maximum aggregate size in Table 460-1.

(2) Warning bands are defined as the area between the JMF limits and the warning limits.

460.2.8.2.1.6 Job Mix Formula Adjustment

Replace the entire text with the following effective with the January 2014 letting:

(1) The contractor may request adjustment of the JMF according to the department's test method number 1559. Have an HTCP HMA technician certified at a level appropriate for process control and troubleshooting or mix design submit a written JMF adjustment request. Ensure that the resulting JMF is within specified master gradation bands. The department will have an HMA technician certified at level III review the proposed adjustment and, if acceptable, issue a revised JMF.

(2) The department will not allow adjustments that do the following:

- Exceed specified JMF tolerance limits.
- Reduce the JMF asphalt content unless the production VMA running average meets or exceeds the minimum VMA design requirement defined in table 460-1for the mixture produced.

(3) Have an HMA technician certified at level II make related process adjustments. If mixture redesign is necessary, submit a new JMF, subject to the same specification requirements as the original JMF.

520.3.8 Protection After Laying

Delete the entire subsection.

614.2.1 General

Replace paragraphs five and six with the following effective with the December 2013 letting:

(5) Furnish zinc coated wire rope and fitting conforming to the plans and galvanized according to ASTM A741.

(6) Before installation store galvanized components above ground level and away from surface run off. The department may reject material if the zinc coating is physically damaged or oxidized.

(7) Provide manufacturer's drawings, and installation and maintenance instructions when providing proprietary systems.

614.2.3 Steel Rail and Fittings

Replace paragraph one with the following effective with the December 2013 letting:

(1) Furnish galvanized steel rail conforming to AASHTO M180 class A, type II beam using the single-spot test coating requirements. Furnish plates, anchor plates, post mounting brackets, and other structural steel components conforming to 506.2.2.1 and hot-dip galvanized according to ASTM A123.

614.2.7 Crash Cushions

Replace paragraph one with the following effective with the December 2013 letting:

(1) Furnish permanent and temporary crash cushions from the department's approved products list. Use cushions as wide or wider than the plan back-width. Furnish transitions conforming to the crash cushion manufacturer's design and specifications. Submit manufacturer crash cushion and transition design details to engineer before installing.

616.3.1 General

Replace paragraph six with the following effective with the December 2013 letting:

(6) Remove and dispose of all excess excavation and surplus materials from the fence site.

618.3.3 Restoration

Replace paragraph one with the following effective with the December 2013 letting:

(1) Upon termination of hauling operations and before conditional final acceptance, restore all haul roads, including drainage facilities and other components, to the equivalent of pre-hauling conditions.

627.3.1 General

Replace paragraph four with the following effective with the December 2013 letting:

(4) Maintain the mulched areas and repair all areas damaged by wind, erosion, traffic, fire or other causes.

637.3.2.1 General

Delete paragraph three effective with the December 2013 letting.

670.3.4.2 Post-Construction Work

Replace paragraph one with the following effective with the December 2013 letting:

(1) Submit 5 copies of ITS documentation including but not limited to the following:

- Operator's manual: for contractor furnished equipment, submit a manual containing detailed operating instructions for each different type or model of equipment and or operation performed.
- Maintenance procedures manuals: for contractor furnished equipment, submit a manual containing detailed preventive and corrective maintenance procedures for each type or model of equipment furnished.
- Cabinet fiber optic wiring diagram: submit a cabinet wiring diagram, identified by location for each cabinet. Include both electrical wiring and fiber optic conductor and cable connections. Place one copy of the fiber optic wiring diagram in a weatherproof holder in the cabinet. Deliver the other copies to the engineer.
- As-built drawings: submit final as-built drawings that detail the final placement of all conduit, cabling, equipment, and geometric modifications within the contract. Provide all documentation in an electronic format adhering to the region’s ITS computer aided drafting standards and according to the department’s as-built requirements. The department will review the as-built drawings for content and electronic format. Modify both the content and format of as-built drawings until meeting all requirements.
- Equipment inventory list: submit an inventory list including serial number, make, model, date installed, and location installed of all equipment installed under the contract.

Errata

Make the following corrections to the 2014 edition of the standard specifications:

415.3.14 Protecting Concrete

Correct errata by referencing the opening to service specification.

(1) Erect and maintain suitable barricades and, if necessary, provide personnel to keep traffic off the newly constructed pavement until it is opened for service as specified in 415.3.15. Conform to 104.6 for methods of handling and facilitating traffic.

501.2.9 Concrete Curing Materials

Correct errata by changing AASHTO M171 to ASTM C171.

(2) Furnish sheeting conforming to ASTM C171 for white opaque polyethylene film, except that the contractor may use clear or black polyethylene for cold weather protection.

607.2 Materials

Correct errata by changing AASHTO M198 to ASTM C990.

(1) Use materials conforming to the requirements for the class of material named and specified below.

Composite pipe, couplings, fittings and joint materials	ASTM D2680
Annular rubber and plastic gaskets for flexible, watertight joints	ASTM C990
External rubber gaskets, mastic, and protective film	ASTM C877
Mortar	519.2.3

637.2.1.3 Sheet Aluminum

Correct errata by changing ASTM B449 to B921 and eliminating the specification for coating thickness.

(4) Degrease, etch, and coat the sign blank on both sides with a chromate treatment conforming to ASTM B921, class 2.

637.3.3.4 Performance

Correct errata to reference to 105.11.2.3 as revised to implement changes to the finals process.

(1) Under 105.11.2.3 the department may revoke acceptance and direct the contractor to repair or replace previously accepted sign installations if the department subsequently discovers evidence of defective materials or improper installation. Deficiencies that warrant department action include but are not limited to the following:

- Sign posts more than five degrees out of plumb.
- Signs twisted by more than 5 degrees from plan orientation.
- Signs with delaminated or warped plywood.
- Signs with bubbling, fading, delaminating, or buckling sheeting.

646.3.3.4 Proving Period

Correct errata to reference to 105.11.2.3 as revised to implement changes to the finals process.

(4) Replace all marking within sections with a percent failing more than 10% and repair or replace all markings that, in the engineer's assessment, show evidence of improper construction. If post-acceptance inspections uncover evidence of defective materials or improper construction, the department may revoke acceptance under 105.11.2.3.

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://www.dot.wi.gov/business/civilrights/laborwages/index.htm

(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://www.dot.wi.gov/business/civilrights/laborwages/docs/crc-payroll-manual.pdf

DECEMBER 2013

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://roadwaystandards.dot.wi.gov/standards/cmm/cm-02-28.pdf#cm2-28.5

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://roadwaystandards.dot.wi.gov/standards/forms/ws4567.doc

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 contacts.

While the wage rates shown are the minimum rates required by the contract to be paid during its life, this in 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
DOUGLAS 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, 2014

CLASSIFICATION: Contractors are required to call the Department of Workforce Development if there are any questions reqarding 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.

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	$	$	$
Bricklayer, Blocklayer or Stonemason	35.93	16.21	52.14
Carpenter	30.48	15.90	46.38
Cement Finisher	32.65	17.32	49.97
Future Increase(s): Add $1.87 on 6/1/14; Add $1.87 on 6/1/15;Add $1.75 on 6/1/16. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.			
Electrician	29.72	18.24	47.96
Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.			
Fence Erector	16.00	0.15	16.15
Ironworker	34.15	22.05	56.20
Future Increase(s): Add $1.35/hr on 5/1/2014; Add $1.50/hr on 5/1/2015. Premium Pay: DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day.			
Line Constructor (Electrical)	38.25	17.31	55.56
Painter	21.87	11.37	33.24
Pavement Marking Operator	30.00	0.00	30.00
Piledriver	30.98	18.75	49.73
Roofer or Waterproofer	30.50	16.87	47.37
Teledata Technician or Installer	16.50	0.91	17.41
Tuckpointer, Caulker or Cleaner	34.57	15.25	49.82
Underwater Diver (Except on Great Lakes)	34.48	15.90	50.38
Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	34.43	15.24	49.67

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	$	$	$
Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	16.89	47.49
Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.58	40.36
Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45
TRUCK DRIVERS			
Single Axle or Two Axle	34.22	19.90	54.12
Three or More Axle	24.52	17.77	42.29
Future Increase(s): Add $1.30/hr on 6/1/2014. 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	29.27	20.40	49.67
Future Increase(s): Add $1.75/hr on 6/1/14); Add $1.25/hr on 6/1/15); Add $1.30/hr on 6/1/16); Add $1.25/hr on 6/ 1/ 17. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http:/ / www.dot.wi.gov/ business/ civilrights/ laborwages/ pwc. htm.			
Pavement Marking Vehicle	23.31	17.13	40.44
Shadow or Pilot Vehicle	34.22	19.90	54.12
Truck Mechanic	23.31	17.13	40.44
LABORERS			
General Laborer	29.04	14.63	43.67
Future Increase(s): Add $1.60/hr on 6/1/2014. 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	19.00	11.06	30.06
Landscaper	29.04	14.63	43.67
Future Increase(s): Add $1.60/hr on 6/1/14. 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	25.67	14.63	40.30
Future Increase(s): Add $1.60/hr on 6/1/2014. 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)	18.31	9.56	27.87
Railroad Track Laborer	21.31	15.28	36.59
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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/ 1/ 2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http:/ / www.dot.wi.gov/ business/ civilrights/ laborwages/ pwc. htm.	36.72	20.40	57.12
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 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. Future Increase(s): Add $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/ 1/ 2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http:/ / www.dot.wi.gov/ business/ civilrights/ laborwages/ pwc. htm.	36.22	20.40	56.62
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 Mfgr.'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	35.72	20.40	56.12

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	$	$	$
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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/ 1/ 2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http:/ / www.dot.wi.gov/ business/ civilrights/ laborwages/ pwc. htm.			
Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/ 1/ 2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http:/ / www.dot.wi.gov/ business/ civilrights/ laborwages/ pwc. htm.	35.46	20.40	55.86
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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/ 1/ 2017. Premium Pay: DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: http:/ / www.dot.wi.gov/ business/ civilrights/ laborwages/ pwc. htm.	35.17	20.40	55.57
Fiber Optic Cable Equipment.	26.69	13.05	39.74
Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
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.	38.80	20.17	58.97
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.	34.50	20.04	54.54
Work Performed on the Great Lakes Including Deck Equipment Operator,	34.50	20.04	54.54

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	$	$	$
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.			

State of Wisconsin Department of Workforce Development Equal Rights Division	**DEPARTMENTAL ORDER**

ISSUE DATE: 4/2/2014

PROJECT:

SUPERIOR SAFETY & WEIGHT ENFORCEMENT FACILITY #72
PARKLAND TOWN, DOUGLAS COUNTY, WI
Determination No. 201400996 [Owner Project No. 1190-43-71]

PROJECT OWNER:	REQUESTER:
ROBERT SPOERL, ROADSIDE FACILITIES ENGINEER WI DOT P O BOX 7986 4802 SHEBOYGAN AVE MADISON, WI 537077986	ROBERT SPOERL, ROADSIDE FACILITIES ENGINEER WI DOT P O BOX 7986 4802 SHEBOYGAN AVE MADISON, WI 537077986
ADDITIONAL CONTACT:	

The department received an application for prevailing wage rate determination for the above-captioned project. The department conducted a survey to determine the prevailing wage rate for the trade(s) or occupation(s) needed to complete the project. The survey's findings appear in the attached project determination.

If you believe that the wage rate for any trade or occupation does not accurately reflect the prevailing wage rate in the city, village or town where the project is located, you may ask the department to conduct an administrative review of such wage rate. You must submit this request in writing within 30 days from the date indicated above. Additionally, your request must include wage rate information from at least three similar projects in the city, village or town where the proposed project is located and on which some work has been performed by the contested trade(s) during the current survey period and was previously considered by the department in issuing the attached determination. See DWD 290.10 of the Wisconsin Administrative Code and either s. 66.0903(3)(br), Stats., or s. 103.49(3)(c), Stats., for a complete explanation of the administrative review process.

Enclosures

It is hereby ordered that the prevailing wage rates set forth in the attached project determination shall only be applicable to the above referenced project. This order is a **FINAL ORDER** of the department unless a timely request for an administrative review is filed with the department.

ISSUED BY:

Equal Rights Division
Labor Standards Bureau
Construction Wage Standards Section
P.O. Box 8928, Madison, WI 53708-8928
(608)266-6861

Web Site: http://dwd.wisconsin.gov/er/

PREVAILING WAGE RATE DETERMINATION
Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 103.49, Wis. Stats.
Issued On: 4/2/2014

DETERMINATION NUMBER: 201400996

EXPIRATION DATE: Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2014. If NOT, You MUST Reapply.

PROJECT NAME: SUPERIOR SAFETY & WEIGHT ENFORCEMENT FACILITY #72

PROJECT NO: 1190-43-71

PROJECT LOCATION: PARKLAND TOWN, DOUGLAS COUNTY, WI

CONTRACTING AGENCY: WI DOT

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, whevenever 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 journeyperson'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.

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.
(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.

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 All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer	32.93	19.81	52.74
102	Boilermaker Future Increase(s): Add $1.50/hr on 1/01/2015; Add $1.50/hr. on 01/01/2016	32.05	28.04	60.09
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add $.75/hr on 06/01/2014 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.	35.93	16.21	52.14
104	Cabinet Installer	30.48	15.90	46.38
105	Carpenter	28.37	14.13	42.50
106	Carpet Layer or Soft Floor Coverer	30.48	15.90	46.38
107	Cement Finisher Future Increase(s): Add $.50/hr on 5/1/2014; Add $ .50/hr. on 6/1/2015; Add $ .50/hr. on 5/1/2016;	30.19	16.30	46.49
108	Drywall Taper or Finisher	29.87	15.35	45.22
109	Electrician	31.27	23.51	54.78
110	Elevator Constructor	42.86	26.33	69.19
111	Fence Erector	16.00	0.15	16.15
112	Fire Sprinkler Fitter	47.23	0.00	47.23
113	Glazier	34.19	17.07	51.26
114	Heat or Frost Insulator	26.82	25.34	52.16
115	Insulator (Batt or Blown)	15.00	9.50	24.50

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
116	Ironworker Future Increase(s): Add $1.55/hr on 5/1/2014; Add $1.65/hr on 5/1/2015. 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.	29.34	22.05	51.39
117	Lather	28.37	14.13	42.50
118	Line Constructor (Electrical)	38.25	17.31	55.56
119	Marble Finisher	26.89	19.18	46.07
120	Marble Mason	35.93	16.21	52.14
121	Metal Building Erector	23.00	0.72	23.72
122	Millwright	31.47	8.18	39.65
123	Overhead Door Installer	20.95	4.94	25.89
124	Painter	28.41	14.77	43.18
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
127	Pipeline Fuser or Welder (Gas or Utility)	31.82	19.74	51.56
129	Plasterer	30.77	17.77	48.54
130	Plumber	36.27	16.98	53.25
132	Refrigeration Mechanic	39.26	19.25	58.51
133	Roofer or Waterproofer	30.50	16.87	47.37
134	Sheet Metal Worker	30.66	20.99	51.65
135	Steamfitter	36.27	16.98	53.25
137	Teledata Technician or Installer	16.50	0.91	17.41
138	Temperature Control Installer	32.59	17.91	50.50
139	Terrazzo Finisher	26.89	19.18	46.07
140	Terrazzo Mechanic	30.20	18.42	48.62
141	Tile Finisher	23.85	17.18	41.03
142	Tile Setter	30.77	16.70	47.47
143	Tuckpointer, Caulker or Cleaner	34.57	15.25	49.82
144	Underwater Diver (Except on Great Lakes)	34.48	15.90	50.38
146	Well Driller or Pump Installer	25.32	15.65	40.97

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
147	Siding Installer	25.92	18.04	43.96
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.16	14.34	43.50
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle Future Increase(s): Add $1.30/hr on 6/1/2014. 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.	24.37	17.77	42.14
203	Three or More Axle	19.00	9.31	28.31
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	19.00	9.31	28.31
207	Truck Mechanic	19.00	9.31	28.31

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	21.81	15.28	37.09
302	Asbestos Abatement Worker	19.00	11.06	30.06
303	Landscaper	21.01	9.96	30.97
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	19.69	15.05	34.74
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	9.56	27.87
314	Railroad Track Laborer	21.31	15.28	36.59
315	Final Construction Clean-Up Worker	28.31	16.62	44.93

HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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 Mfgr's Rated Capacity of 130,000 Lbs. or Over; Backhoe (Track Type) Having a Mfgr'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).	32.89	18.96	51.85
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).	32.89	18.96	51.85
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.	30.82	18.96	49.78
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
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. Premium Increase(s): Add $.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	41.65	21.71	63.36
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.	37.10	21.57	58.67

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.	34.50	20.04	54.54

HEAVY EQUIPMENT OPERATORS
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. 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.	35.62	18.96	54.58
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). Premium Increase(s): Add $.25/hr for all >45 Ton lifting capacity cranes	34.62	18.96	53.58
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).	33.42	18.96	52.38

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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).	32.89	18.96	51.85
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.	30.82	18.96	49.78
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.	30.19	18.96	49.15
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment).	36.34	21.14	57.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment). Future Increase(s): Add $1.60/hr on 06/01/2014; Add $1.65/hr on 06/01/2015.	32.32	18.55	50.87
516	Fiber Optic Cable Equipment	26.69	13.05	39.74

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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason 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.	35.10	18.40	53.50
105	Carpenter Future Increase(s): Add $1.25/hr on 6/2/2014. 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.	33.68	19.81	53.49
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/14; Add $1.87 on 6/1/15; 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.	33.51	16.13	49.64
109	Electrician 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.	32.82	22.61	55.43
111	Fence Erector	16.00	0.15	16.15
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
125	Pavement Marking Operator	16.00	7.35	23.35
126	Piledriver	30.98	15.90	46.88
130	Plumber	33.75	14.07	47.82
135	Steamfitter	35.77	16.73	52.50
137	Teledata Technician or Installer	16.50	0.91	17.41

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
143	Tuckpointer, Caulker or Cleaner	34.57	15.25	49.82
144	Underwater Diver (Except on Great Lakes)	38.80	20.17	58.97
146	Well Driller or Pump Installer	25.32	15.65	40.97
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.16	14.34	43.50
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	30.00	15.00	45.00
203	Three or More Axle	16.00	7.35	23.35
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	16.00	7.35	23.35
207	Truck Mechanic	16.00	7.35	23.35

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer 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.	25.35	14.62	39.97
303	Landscaper	25.28	11.46	36.74
304	Flagperson or Traffic Control Person	17.41	10.10	27.51
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	9.56	27.87
314	Railroad Track Laborer	21.31	15.28	36.59

HEAVY EQUIPMENT OPERATORS
SEWER, WATER OR TUNNEL WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. Future Increase(s): Add $1.05/hr on 6/2/2014; Add $1.55/hr on 6/1/2015. Premium Increase(s): Add $.25/hr for operating tower crane.	36.84	19.45	56.29
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 $1.05/hr on 6/2/2014; Add $1.55/hr on 6/1/2015. Premium Increase(s): Add $.25/hr for operating tower crane.	36.06	19.45	55.51
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).	32.89	18.96	51.85

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. Future Increase(s): Add $1.05/hr on 6/2/2014; Add $1.55/hr on 6/1/2015. Premium Increase(s): Add $.25/hr for operating tower crane.	35.11	19.45	54.56
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	20.94	51.13
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	29.69	18.46	48.15
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
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.	38.80	20.17	58.97
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.	34.50	20.04	54.54
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.	34.50	20.04	54.54

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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	35.93	16.21	52.14
105	Carpenter	32.93	19.93	52.86
107	Cement Finisher	30.09	17.81	47.90
109	Electrician	31.27	22.81	54.08
111	Fence Erector	16.00	0.15	16.15
116	Ironworker	29.24	21.20	50.44
118	Line Constructor (Electrical)	38.25	17.31	55.56
124	Painter	28.41	14.77	43.18
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
133	Roofer or Waterproofer	30.50	16.87	47.37
137	Teledata Technician or Installer	16.50	0.91	17.41
143	Tuckpointer, Caulker or Cleaner	34.57	15.25	49.82
144	Underwater Diver (Except on Great Lakes)	38.80	20.17	58.97
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	34.43	15.24	49.67
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	30.00	15.00	45.00

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
203	Three or More Axle	17.75	1.95	19.70
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	17.75	1.95	19.70
206	Shadow or Pilot Vehicle	30.00	15.00	45.00
207	Truck Mechanic	17.75	1.95	19.70

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	14.50	13.79	28.29
303	Landscaper Future Increase(s): Add $1.60/hr on 6/1/14. 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).	29.04	14.63	43.67
304	Flagperson or Traffic Control Person	17.41	10.10	27.51
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	9.56	27.87
314	Railroad Track Laborer	21.31	15.28	36.59

HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium 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://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	36.72	20.40	57.12
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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium 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://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium 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://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	35.72	20.40	56.12
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 Sawer (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.	33.96	19.79	53.75
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.	30.32	18.46	48.78
546	Fiber Optic Cable Equipment.	26.69	13.05	39.74

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
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.	38.80	20.17	58.97
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.	34.50	20.04	54.54
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.	34.50	20.04	54.54

HEAVY EQUIPMENT OPERATORS
ASPHALT PAVEMENT OR OTHER WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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.	35.12	18.46	53.58
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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium 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://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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.	25.18	19.20	44.38
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 Sawer (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. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017.	28.65	19.20	47.85
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 $1.75/hr on 6/1/2014); Add $1.25/hr on 6/1/2015); Add $1.30/hr on 6/1/2016); Add $1.25/hr on 6/1/2017. Premium 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://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm.	35.17	20.40	55.57

556	Fiber Optic Cable Equipment.	26.69	13.05	39.74

********** END OF RATES **********

Department of Workforce Development
Equal Rights Division
P.O. Box 8928
Madison, WI 53708-8928
Telephone: (608) 266-6860
Fax: (608) 267-4592
TTY: (608) 264-8752

STATE OF WISCONSIN
DWD
Department of Workforce Development

Scott Walker, Governor
Reginald J. Newson, Secretary

The documents following the Prevailing Wage Rate Determination consist of seventeen pages (including this one) of various forms/documents that will be used throughout the completion of the project. 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
	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	2
	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

02/19/2014

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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:

http://dwd.wisconson.gov/er/prevailing_wage_rate/pw_online_determinations.htm

- 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/prevailing_wage_rate/default.htm. For further assistance, call the Equal Rights Division at 608-266-6861 and ask for prevailing wage.

State of Wisconsin
Department of Workforce Development
Equal Rights Division
Labor Standards Bureau

POST THE WHITE SHEET

As the public entity receiving this prevailing wage rate determination, YOU ARE REQUIRED by law to post the prevailing wage rate determination (i.e., white sheet) in at least one conspicuous and easily accessible place on the project site that is available to all construction workers. The white sheet must remain posted from the onset of the project until all construction labor on the project has been completed.
[*See,* Wis. Admin. Code §DWD 290.12(1)]

Posting the white sheet inside the general contractor's trailer does not meet this requirement. That placement is not available/accessible to all workers and is not a location over which you have control.

If you have questions about posting, please call (608)266-6861 and ask for prevailing wage intake.

Consolidated List of Debarred Contractors
Prepared and Issued By
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 Julie Eckenwalder, Equal Rights Division, P. O. Box 8928, Madison, WI 53708 or call (608) 266-3148. Deaf, hearing or speech-impaired callers may contact the department by calling its TDD number (608) 264-8752.

Name of Contractor	Address	Effective Date	Termination Date	Cause Code	Date of Violation(s)	Limitations/ Deviations
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
Atkins, Scott	*See,* Freedom Insulation, Inc					
Boecker, Roger	*See,* R-Way Pumping, Inc					
Cargill Heating and Air Conditioning Company, Inc	3049 Edgewater La La Crosse, WI 54603	3/1/14	2/28/17	1 and 2	2011	None
Castlerock Commercial Construction, Inc	PO Box 11699 Milwaukee, WI 53211-0699	2/1/12	1/31/15	1, 2 and 4	2009 & 2010	None
Dem/Ex Group, Inc	805 S Adams St Manito, IL 61546	12/1/11	11/30/14	1 and 2	2010	None
Fisher, Ed &/or Fisher, Rhonda	*See*, Dem/Ex Group, Inc					

Name of Contractor	Address	Effective Date	Termination Date	Cause Code	Date of Violation(s)	Limitations/ Deviations
Freedom Insulation, Inc	117925 219th Ave Chippewa Falls, WI 54729	9/1/11	8/31/14	1	2008-2010	None
Galstad, Michael E (aka Michael Earl Galstad)	*See,* Cargill Heating and Air Conditioning Company, Inc					
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					
Ofstie, Darin	*See*, Precision Excavating and Grading, LLC					
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
Thull, Gerald T	*See,* JT Roofing, Inc					

Cause Code: 1 = Failure to Pay Straight Time 2 = Failure to Pay Overtime 3 = Kickback 4 = Payroll Records.

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STATE OF WISCONSIN
DWD
Department of Workforce Development

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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.

State of Wisconsin
Department of Workforce Development
Equal Rights Division

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

State of Wisconsin
Department of Workforce Development
Equal Rights Division

Prime Contractor Affidavit of Compliance With Prevailing Wage Rate Determination

Authorization for this form is provided under Sections 66.0903(9)(c), 66.0904(7)(c) and 103.49(4r)(c) Wisconsin Statutes.
The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.
Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m), Wisconsin Statutes].

This form must **ONLY** be filed with the **Awarding Agency** indicated below.

State Of))SS County Of)	Project Name	
	DWD Determination Number	Project Number (if applicable)
	Date Determination Issued	Date of Contract
	Awarding Agency	
	Date Work Completed	

After being duly sworn, the person whose name and signature appears below hereby states under penalty of perjury that

- **I am** the duly authorized officer of the corporation, partnership, sole proprietorship or business indicated below and have recently completed all of the work required under the terms and conditions of a contract with the above-named awarding agency and make this affidavit in accordance with the requirements set forth in Section 66.0903(9)(c), 66.0904(7)(c) or 103.49(4r)(c), Wisconsin Statutes and Chapter DWD 290 of the Wisconsin Administrative Code in order to obtain FINAL PAYMENT from such awarding agency.
- **I have** fully complied with all the wage and hour requirements applicable to this project, including all of the requirements set forth in the prevailing wage rate determination indicated above which was issued for such project by the Department of Workforce Development on the date indicated above.
- **I have** received the required affidavit of compliance from each of my agents and subcontractors that performed work on this project and have listed each of their names and addresses on page 2 of this affidavit.
- **I have** full and accurate records that clearly indicate the name and trade or occupation of every worker(s) that I employed on this project, including an accurate record of the hours worked and actual wages paid to such worker(s).
- **I will** retain the records and affidavit(s) described above and make them available for inspection for a period of at least three (3) years from the completion date indicated above at the address indicated below and shall not remove such records or affidavit(s) without prior notification to the awarding agency indicated above.

Name of Corporation, Partnership, Sole Proprietorship, Business, State Agency or Local Governmental Unit				
Street Address	City	State	Zip Code	Telephone Number
Print Name of Authorized Officer			Date Signed	
Signature of Authorized Officer				

List of Agents and Subcontractors

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		
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

State of Wisconsin
Department of Workforce Development
Equal Rights Division

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

State of Wisconsin
Department of Workforce Development
Equal Rights Division
Labor Standards Bureau

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)	Requester 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 February 2014)

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 govern-mental 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.

CONTRACT: 20141111015 PROJECT(S): 1190-43-71 FEDERAL ID(S): N/A

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
	SECTION 0001 CONTRACT ITEMS					
0010	203.0100 REMOVING SMALL PIPE CULVERTS	7.000 EACH		.		.
0020	204.0100 REMOVING PAVEMENT	11,100.000 SY		.		.
0030	204.0155 REMOVING CONCRETE SIDEWALK	40.000 SY		.		.
0040	204.0180 REMOVING DELINEATORS AND MARKERS	96.000 EACH		.		.
0050	204.0195 REMOVING CONCRETE BASES	23.000 EACH		.		.
0060	204.0220 REMOVING INLETS	2.000 EACH		.		.
0070	204.0225 REMOVING SEPTIC TANKS	1.000 EACH		.		.
0080	204.0230 REMOVING BUILDING (STATION) 01. 338"E"+40	LUMP	LUMP			.
0090	204.0230 REMOVING BUILDING (STATION) 02. 338"E"+90	LUMP	LUMP			.
0100	204.0265 ABANDONING WELLS	1.000 EACH		.		.

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CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0110	204.9060.S REMOVING (ITEM DESCRIPTION) 01. STATIC SCALE	1.000 EACH		.		.
0120	205.0100 EXCAVATION COMMON	187,400.000 CY		.		.
0130	208.1100 SELECT BORROW	140,000.000 CY		.		.
0140	209.0100 BACKFILL GRANULAR	210.000 CY		.		.
0150	213.0100 FINISHING ROADWAY (PROJECT) 01. 1190-43-71	1.000 EACH		.		.
0160	305.0110 BASE AGGREGATE DENSE 3/4-INCH	32,100.000 TON		.		.
0170	415.0100 CONCRETE PAVEMENT 10-INCH	41,550.000 SY		.		.
0180	415.0110 CONCRETE PAVEMENT 11-INCH	270.000 SY		.		.
0190	415.0210 CONCRETE PAVEMENT GAPS	4.000 EACH		.		.
0200	415.0410 CONCRETE PAVEMENT APPROACH SLAB	70.000 SY		.		.
0210	416.0610 DRILLED TIE BARS	1,635.000 EACH		.		.

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CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0220	416.0620 DRILLED DOWEL BARS	224.000 EACH		.		.
0230	416.1010 CONCRETE SURFACE DRAINS	2.000 CY		.		.
0240	455.0105 ASPHALTIC MATERIAL PG58-28	100.000 TON		.		.
0250	455.0605 TACK COAT	110.000 GAL		.		.
0260	460.1101 HMA PAVEMENT TYPE E-1	1,660.000 TON		.		.
0270	460.2000 INCENTIVE DENSITY HMA PAVEMENT	8,390.000 DOL	1.00000		8390.00	
0280	465.0305 ASPHALTIC SURFACE SAFETY ISLANDS	156.000 TON		.		.
0290	465.0400 ASPHALTIC SHOULDER RUMBLE STRIPS	2,400.000 LF		.		.
0300	520.8000 CONCRETE COLLARS FOR PIPE	3.000 EACH		.		.
0310	522.0318 CULVERT PIPE REINFORCED CONCRETE CLASS IV 18-INCH	180.000 LF		.		.
0320	522.0324 CULVERT PIPE REINFORCED CONCRETE CLASS IV 24-INCH	380.000 LF		.		.

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0330	522.0336 CULVERT PIPE REINFORCED CONCRETE CLASS IV 36-INCH	105.000 LF		.		.
0340	522.1012 APRON ENDWALLS FOR CULVERT PIPE REINFORCED CONCRETE 12-INCH	1.000 EACH		.		.
0350	522.1018 APRON ENDWALLS FOR CULVERT PIPE REINFORCED CONCRETE 18-INCH	4.000 EACH		.		.
0360	522.1024 APRON ENDWALLS FOR CULVERT PIPE REINFORCED CONCRETE 24-INCH	10.000 EACH		.		.
0370	522.1030 APRON ENDWALLS FOR CULVERT PIPE REINFORCED CONCRETE 30-INCH	1.000 EACH		.		.
0380	522.1036 APRON ENDWALLS FOR CULVERT PIPE REINFORCED CONCRETE 36-INCH	4.000 EACH		.		.
0390	602.0410 CONCRETE SIDEWALK 5-INCH	1,850.000 SF		.		.
0400	602.0505 CURB RAMP DETECTABLE WARNING FIELD YELLOW	16.000 SF		.		.
0410	606.0200 RIPRAP MEDIUM	27.000 CY		.		.

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CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0420	608.0412 STORM SEWER PIPE REINFORCED CONCRETE CLASS IV 12-INCH	100.000 LF		.		.
0430	608.0415 STORM SEWER PIPE REINFORCED CONCRETE CLASS IV 15-INCH	380.000 LF		.		.
0440	608.0424 STORM SEWER PIPE REINFORCED CONCRETE CLASS IV 24-INCH	345.000 LF		.		.
0450	608.0430 STORM SEWER PIPE REINFORCED CONCRETE CLASS IV 30-INCH	175.000 LF		.		.
0460	611.0606 INLET COVERS TYPE B	2.000 EACH		.		.
0470	611.0612 INLET COVERS TYPE C	1.000 EACH		.		.
0480	611.0624 INLET COVERS TYPE H	4.000 EACH		.		.
0490	611.2004 MANHOLES 4-FT DIAMETER	2.000 EACH		.		.
0500	611.3220 INLETS 2X2-FT	1.000 EACH		.		.
0510	611.3230 INLETS 2X3-FT	4.000 EACH		.		.
0520	614.2300 MGS GUARDRAIL 3	848.000 LF		.		.

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CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0530	614.2610 MGS GUARDRAIL TERMINAL EAT	4.000 EACH		.		.
0540	614.2620 MGS GUARDRAIL TERMINAL TYPE 2	4.000 EACH		.		.
0550	616.0700.S FENCE SAFETY	400.000 LF		.		.
0560	618.0100 MAINTENANCE AND REPAIR OF HAUL ROADS (PROJECT) 01. 1190-43-71	1.000 EACH		.		.
0570	619.1000 MOBILIZATION	1.000 EACH		.		.
0580	620.0300 CONCRETE MEDIAN SLOPED NOSE	72.000 SF		.		.
0590	625.0100 TOPSOIL	3,000.000 SY		.		.
0600	625.0500 SALVAGED TOPSOIL	37,200.000 SY		.		.
0610	627.0200 MULCHING	39,000.000 SY		.		.
0620	628.1104 EROSION BALES	50.000 EACH		.		.
0630	628.1504 SILT FENCE	6,590.000 LF		.		.

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0640	628.1520 SILT FENCE MAINTENANCE	6,590.000 LF		.		.
0650	628.1905 MOBILIZATIONS EROSION CONTROL	2.000 EACH		.		.
0660	628.1910 MOBILIZATIONS EMERGENCY EROSION CONTROL	4.000 EACH		.		.
0670	628.2002 EROSION MAT CLASS I TYPE A	10,000.000 SY		.		.
0680	628.7005 INLET PROTECTION TYPE A	2.000 EACH		.		.
0690	628.7010 INLET PROTECTION TYPE B	1.000 EACH		.		.
0700	628.7015 INLET PROTECTION TYPE C	4.000 EACH		.		.
0710	628.7504 TEMPORARY DITCH CHECKS	280.000 LF		.		.
0720	628.7555 CULVERT PIPE CHECKS	28.000 EACH		.		.
0730	629.0210 FERTILIZER TYPE B	25.000 CWT		.		.
0740	630.0180 SEEDING MIXTURE NO. 80	700.000 LB		.		.

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CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0750	630.0400 SEEDING NURSE CROP	600.000 LB		.		.
0760	631.1000 SOD LAWN	700.000 SY		.		.
0770	632.0101 TREES (SPECIES, ROOT, SIZE) 01. PIN CHERRY, 8-FOOT HEIGHT	3.000 EACH		.		.
0780	632.0201 SHRUBS (SPECIES, ROOT, SIZE) 01. SWEETFERN, 1-GALLON	45.000 EACH		.		.
0790	632.0201 SHRUBS (SPECIES, ROOT, SIZE) 02. DWARF PINK PAVEMENT ROSE, 2-GALLON	17.000 EACH		.		.
0800	632.0201 SHRUBS (SPECIES, ROOT, SIZE) 03. GRO-LOW FRAGRANT SUMAC, 18-INCH SPREAD	97.000 EACH		.		.
0810	632.9101 LANDSCAPE PLANTING SURVEILLANCE AND CARE CYCLES 01. 14-DAY INTERVALS	24.000 EACH		.		.
0820	633.0200 DELINEATORS FLEXIBLE	200.000 EACH		.		.
0830	633.5200 MARKERS CULVERT END	20.000 EACH		.		.
0840	634.0616 POSTS WOOD 4X6-INCH X 16-FT	32.000 EACH		.		.

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0850	634.0618 POSTS WOOD 4X6-INCH X 18-FT	21.000 EACH		.		.
0860	634.0620 POSTS WOOD 4X6-INCH X 20-FT	13.000 EACH		.		.
0870	635.0200 SIGN SUPPORTS STRUCTURAL STEEL HS	2,280.000 LB		.		.
0880	636.0100 SIGN SUPPORTS CONCRETE MASONRY	11.000 CY		.		.
0890	636.1000 SIGN SUPPORTS STEEL REINFORCEMENT HS	664.000 LB		.		.
0900	637.1210 SIGNS TYPE I REFLECTIVE H	201.000 SF		.		.
0910	637.2210 SIGNS TYPE II REFLECTIVE H	1,376.000 SF		.		.
0920	638.2602 REMOVING SIGNS TYPE II	34.000 EACH		.		.
0930	638.3000 REMOVING SMALL SIGN SUPPORTS	35.000 EACH		.		.
0940	642.5401 FIELD OFFICE TYPE D	1.000 EACH		.		.
0950	642.6001 FIELD LABORATORY	1.000 EACH		.		.

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CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0960	643.0100 TRAFFIC CONTROL (PROJECT) 01. 1190-43-71	1.000 EACH		.		.
0970	643.0300 TRAFFIC CONTROL DRUMS	36,855.000 DAY		.		.
0980	643.0420 TRAFFIC CONTROL BARRICADES TYPE III	286.000 DAY		.		.
0990	643.0715 TRAFFIC CONTROL WARNING LIGHTS TYPE C	4,576.000 DAY		.		.
1000	643.0800 TRAFFIC CONTROL ARROW BOARDS	572.000 DAY		.		.
1010	643.0900 TRAFFIC CONTROL SIGNS	4,832.000 DAY		.		.
1020	643.1050 TRAFFIC CONTROL SIGNS PCMS	143.000 DAY		.		.
1030	645.0130 GEOTEXTILE FABRIC TYPE R	180.000 SY		.		.
1040	645.0140 GEOTEXTILE FABRIC TYPE SAS	87,860.000 SY		.		.
1050	646.0106 PAVEMENT MARKING EPOXY 4-INCH	28,390.000 LF		.		.
1060	646.0126 PAVEMENT MARKING EPOXY 8-INCH	1,690.000 LF		.		.

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
1070	646.0600 REMOVING PAVEMENT MARKINGS	6,060.000 LF		.		.
1080	647.0256 PAVEMENT MARKING SYMBOLS EPOXY	6.000 EACH		.		.
1090	647.0456 PAVEMENT MARKING CURB EPOXY	155.000 LF		.		.
1100	647.0566 PAVEMENT MARKING STOP LINE EPOXY 18-INCH	56.000 LF		.		.
1110	647.0606 PAVEMENT MARKING ISLAND NOSE EPOXY	2.000 EACH		.		.
1120	647.0656 PAVEMENT MARKING PARKING STALL EPOXY	3,130.000 LF		.		.
1130	647.0726 PAVEMENT MARKING DIAGONAL EPOXY 12-INCH	2,890.000 LF		.		.
1140	647.0776 PAVEMENT MARKING CROSSWALK EPOXY 12-INCH	140.000 LF		.		.
1150	649.0400 TEMPORARY PAVEMENT MARKING REMOVABLE TAPE 4-INCH	4,680.000 LF		.		.
1160	650.4000 CONSTRUCTION STAKING STORM SEWER	32.000 EACH		.		.
1170	650.4500 CONSTRUCTION STAKING SUBGRADE	10,500.000 LF		.		.

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
1180	650.5500 CONSTRUCTION STAKING CURB GUTTER AND CURB & GUTTER	2,320.000 LF		.		.
1190	650.6000 CONSTRUCTION STAKING PIPE CULVERTS	12.000 EACH		.		.
1200	650.7000 CONSTRUCTION STAKING CONCRETE PAVEMENT	10,500.000 LF		.		.
1210	650.8500 CONSTRUCTION STAKING ELECTRICAL INSTALLATIONS (PROJECT) 01. 1190-43-71	LUMP	LUMP			.
1220	650.9910 CONSTRUCTION STAKING SUPPLEMENTAL CONTROL (PROJECT) 01. 1190-43-71	LUMP	LUMP			.
1230	650.9920 CONSTRUCTION STAKING SLOPE STAKES	5,000.000 LF		.		.
1240	652.0225 CONDUIT RIGID NONMETALLIC SCHEDULE 40 2-INCH	10,600.000 LF		.		.
1250	652.0340 CONDUIT RIGID NONMETALLIC SCHEDULE 80 4-INCH	1,000.000 LF		.		.
1260	653.0135 PULL BOXES STEEL 24X36-INCH	5.000 EACH		.		.
1270	654.0105 CONCRETE BASES TYPE 5	38.000 EACH		.		.

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
1280	654.0200 CONCRETE CONTROL CABINET BASES TYPE 6	1.000 EACH		.		.
1290	655.0620 ELECTRICAL WIRE LIGHTING 8 AWG	17,200.000 LF		.		.
1300	655.0625 ELECTRICAL WIRE LIGHTING 6 AWG	14,940.000 LF		.		.
1310	655.0630 ELECTRICAL WIRE LIGHTING 4 AWG	19,450.000 LF		.		.
1320	656.0200 ELECTRICAL SERVICE METER BREAKER PEDESTAL (LOCATION) 01. OPERATIONS BUILDING	LUMP	LUMP			.
1330	657.0255 TRANSFORMER BASES BREAKAWAY 11 1/2-INCH BOLT CIRCLE	38.000 EACH		.		.
1340	657.0322 POLES TYPE 5-ALUMINUM	38.000 EACH		.		.
1350	657.0710 LUMINAIRE ARMS TRUSS TYPE 4 1/2-INCH CLAMP 12-FT	41.000 EACH		.		.
1360	659.1125 LUMINAIRES UTILITY LED C	41.000 EACH		.		.
1370	690.0150 SAWING ASPHALT	200.000 LF		.		.
1380	690.0250 SAWING CONCRETE	5,000.000 LF		.		.

CONTRACT: 20141111015 PROJECT(S): 1190-43-71 FEDERAL ID(S): N/A

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
1390	715.0415 INCENTIVE STRENGTH CONCRETE PAVEMENT	12,500.000 DOL	1.00000		12500.00	
1400	SPV.0005 SPECIAL 01. CLEARING AND GRUBBING FOR NEW FACILITY	15.000 ACRE	.		.	
1410	SPV.0005 SPECIAL 02. FINAL SHAPING & FINISHING RESTORATION SITE	13.000 ACRE	.		.	
1420	SPV.0055 SPECIAL 01. TELEPHONE SERVICE, SUPERIOR SWEF	1,000.000 DOL	1.00000		1000.00	
1430	SPV.0055 SPECIAL 02. ELECTRICAL SERVICE, SUPERIOR SWEF	5,000.000 DOL	1.00000		5000.00	
1440	SPV.0060 SPECIAL 03. TRASH RECEPTACLES	3.000 EACH	.		.	
1450	SPV.0060 SPECIAL 04. LAMP DISPOSAL HIGH INTENSITY	23.000 EACH	.		.	
1460	SPV.0060 SPECIAL 05. REMOVING LIGHT POLES	23.000 EACH	.		.	
1470	SPV.0060 SPECIAL 06. REMOVING LP TANK	1.000 EACH	.		.	
1480	SPV.0060 SPECIAL 07. UNDERGROUND LP TANKS AND PIPING	3.000 EACH	.		.	

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CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
1490	SPV.0060 SPECIAL 08. LIGHTING CONTROL CABINET TYPE WLP	1.000 EACH		.		.
1500	SPV.0060 SPECIAL 09. PERENNIALS BLACK-EYED SUSAN 1-GALLON	376.000 EACH		.		.
1510	SPV.0060 SPECIAL 10. PERENNIALS PRAIRIE BLAZINGSTAR 4-INCH POT	120.000 EACH		.		.
1520	SPV.0060 SPECIAL 11. GRASSES LITTLE BLUESTEM 4-INCH POT	1,640.000 EACH		.		.
1530	SPV.0060 SPECIAL 12. GRASSES PRAIRIE DROPSEED 4-INCH POT	822.000 EACH		.		.
1540	SPV.0085 SPECIAL 01. SEEDING WETLAND	73.500 LB		.		.
1550	SPV.0090 SPECIAL 01. CONCRETE CURB TYPE SPECIAL	275.000 LF		.		.
1560	SPV.0090 SPECIAL 02. CONCRETE CURB AND GUTTER 36-INCH TYPE A SPECIAL	2,045.000 LF		.		.
1570	SPV.0105 SPECIAL 01. REMOVING EXISTING SIGNAL EQUIPMENT	LUMP	LUMP			.
1580	SPV.0105 SPECIAL 02. LIGHTNING PROTECTION AND GROUNDING SYSTEM	LUMP	LUMP			.
1590	SPV.0105 SPECIAL 03. WELL PUMP AND CONTROLS	LUMP	LUMP			.

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
1600	SPV.0105 SPECIAL 04. WEIGH-IN-MOTION SYSTEM	LUMP	LUMP			.
1610	SPV.0105 SPECIAL 05. WEIGH-IN-MOTION SYSTEM WARRANTY MAINTENANCE	LUMP	LUMP			.
1620	SPV.0105 SPECIAL 06. STATIC SCALE SYSTEM	LUMP	LUMP			.
1630	SPV.0105 SPECIAL 07. STATIC SCALE SYSTEM WARRANTY MAINTENANCE	LUMP	LUMP			.
1640	SPV.0105 SPECIAL 08. COMMUNICATIONS TOWER	LUMP	LUMP			.
1650	SPV.0105 SPECIAL 09. HOLDING TANKS	LUMP	LUMP			.
1660	SPV.0105 SPECIAL 10. EMERGENCY GENERATOR	LUMP	LUMP			.
1670	SPV.0105 SPECIAL 11. CONSTRUCTION STAKING INITIAL LAYOUT PARKING LOT	LUMP	LUMP			.
1680	SPV.0105 SPECIAL 12. CONSTRUCTION STAKING SUBGRADE PARKING LOT	LUMP	LUMP			.
1690	SPV.0105 SPECIAL 13. CONSTRUCTION STAKING CONCRETE PAVEMENT PARKING LOT	LUMP	LUMP			.

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
1700	SPV.0105 SPECIAL 14. SWEF BUILDING, GENERAL CONSTRUCTION	LUMP	LUMP			.
1710	SPV.0105 SPECIAL 15. SWEF BUILDING, PLUMBING	LUMP	LUMP			.
1720	SPV.0105 SPECIAL 16. SWEF BUILDING, HEATING AND VENTILATION	LUMP	LUMP			.
1730	SPV.0105 SPECIAL 17. SWEF BUILDING, ELECTRICAL	LUMP	LUMP			.
1740	SPV.0105 SPECIAL 18. PROJECT CONCRETE CRACK MITIGATION AND REPAIR SPECIAL	LUMP	LUMP			.
1750	SPV.0105 SPECIAL 19. CONSTRUCTION STAKING CONCRETE PAVEMENT JOINT LAYOUT	LUMP	LUMP			.
1760	SPV.0180 SPECIAL 01. CONCRETE PAVEMENT 10-INCH COLORED	2,940.000 SY		.		.
1770	SPV.0180 SPECIAL 02. SCALE APPROACH PAVEMENT REINFORCEMENT	270.000 SY		.		.
1780	SPV.0180 SPECIAL 03. PARKING LOT ISLAND SURFACE	560.000 SY		.		.
1790	SPV.0180 SPECIAL 04. SALVAGE TOPSOIL AT NEW FACILITY	63,000.000 SY		.		.

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1800	SPV.0180 SPECIAL 05. PLACING TOPSOIL AT WETLAND RESTORATION	63,000.000 SY		.		.
1810	SPV.0180 SPECIAL 06. MULCHING CERTIFIED WEED-FREE	63,000.000 SY		.		.
	SECTION 0001 TOTAL					.
	TOTAL BID					.

PLEASE ATTACH SCHEDULE OF ITEMS HERE