HIGHWAY WORK PROPOSAL

Proposal Number: 1 9

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

COUNTY	STATE PROJECT ID	FEDERAL PROJECT ID	PROJECT DESCRIPTION	HIGHWAY
Milwaukee	1000-40-70	WISC 2014 176	Milwaukee Intermodal Station Train Shed and Platforms	Non-Hwy

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, $ 390,000.00 Payable to: Wisconsin Department of Transportation	Attach Proposal Guaranty on back of this PAGE.
Bid Submittal Due Date: May 13, 2014 Time (Local Time): 9:00 AM	Firm Name, Address, City, State, Zip Code **SAMPLE** **NOT FOR BIDDING PURPOSES**
Contract Completion Time September 18, 2015	
Assigned Disadvantaged Business Enterprise Goal 12%	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 Replacing the existing roof structure over the platforms at the Milwaukee Intermodal Station, reconstructing the platforms and tunnel, constructing a fully accessible mezzanine to access the platforms, and replacing all the necessary electrical, lighting and signing.	
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)

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

(Signature of Attorney-in-Fact)

NOTARY FOR PRINCIPAL

(Date)

State of Wisconsin)
) ss.
_____ County)

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

(Signature, Notary Public, State of Wisconsin)

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

(Date Commission Expires)

Notary Seal

NOTARY FOR SURETY

(Date)

State of Wisconsin)
) ss.
_____ County)

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

(Signature, Notary Public, State of Wisconsin)

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

(Date Commission Expires)

Notary Seal

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

CERTIFICATE OF ANNUAL BID BOND

Wisconsin Department of Transportation

DT1305 8/2003

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

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

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

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

(Signature of Authorized Contractor Representative) (Date)

March 2010

LIST OF SUBCONTRACTORS

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

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

Name of Subcontractor	Class of Work	Estimated Value

DECEMBER 2000

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

Instructions for Certification

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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119. Remove Fire Protection Water Lines, Item SPV.0105.57. 521
120. Blower and Tunnel Vent Pipes Demolition and Alterations, Item SPV.0105.58. 521
121. Sawing, Item SPV.0105.59. 523
122. Platform Demolition, Item SPV.0105.60. 524
123. Handrail Removal, Item SPV.0105.61. 525
123. Asphalt Placement and Restoration, Item SPV. 0105.62. 526
124. Column Foundation Monitoring, Item SPV.0105.63. 527
125. Aluminum Windows, Section 08 52 00, Item SPV.0105. 64. 528
126. Ballast Mat, Item SPV.0105. 65. 532
127. Direct Landfill, Item SPV.0195.01. 534

SPECIAL PROVISIONS

1. General.

Perform the work under this construction contract for Project 1000-40-70 Milwaukee Intermodal Station, Train Shed and Platforms, Non-Highway, in the City of Milwaukee, Milwaukee 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 (20130615)

Definitions:
Architect, engineer of record, owner's representative, and construction manager: The secretary of the department of transportation or the secretary's authorized representative limited by the particular duties assigned to the representative, unless specifically noted as agents representing the contractor.

Owner: The Wisconsin Department of Transportation

2. Scope of Work.

The work under this contract shall consist of replacing the existing roof structure over the platforms at the Milwaukee Intermodal Station, reconstructing the platforms and tunnel, constructing a fully accessible mezzanine to access the platforms, and replacing all the necessary electrical, lighting and signing and all incidental items necessary to complete the work as shown on the plans and included in the proposal and contract.
104-005 (20090901)

3. Waiving Bidder Prequalification.

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

Bidders must be approved to bid on a proposal by completing a Proposal Request application online at http://roadwaystandards.dot.wi.gov/hcci/contracting-information/index.shtm

Requests for bidding proposals must be on file with the Bureau of Project Development no later than 11:45 AM of the last business day preceding the letting and must include all outstanding work.

Regarding the standard insurance requirements in standard spec 107.26, the bidder shall provide certificates of insurance prior to execution of the contract.

4. Prosecution and Progress.

Begin work within seven calendar days after the engineer issues a written notice to proceed.

Provide the start date to the engineer in writing within a 14 calendar days 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 seven calendar days before the approved start date.

To revise the start date, submit a written request to the engineer at least two weeks (14 calendar days) before the intended start date. The engineer will approve or deny that request based on the conditions cited in the request and its effect on the department's scheduled resources.

The contract time for completion is based on an expedited work schedule and may require extraordinary forces and equipment.

The completion of work during allowable track closures is based on the expedited work schedule and may require extraordinary forces and equipment.

Migratory Birds
Seagull and other migratory birds' nests have been observed on or under the existing structure. All active nests (when eggs or young are present) of migratory birds are protected under the federal Migratory Bird Treaty Act.

The nesting season for seagulls and other birds is usually between May 1 and August 30. Either prevent active nests from becoming established, or request the depredation permit from the department for work that may disturb or destroy active nests. The department holds a depredation permit from the United States Department of Agriculture. The need for a permit may be avoided by removing the existing structure prior to nest occupation by birds, or clearing nests from all structures before the nests become active in early spring. As a last resort, prevent birds from nesting by installing a suitable netting device on the remaining structure prior to nesting activity. Include the cost for preventing nesting in the cost of shed demolition.

Canadian Pacific Railway
Canadian Pacific Railway (CPR) will be performing track work related to construction of the Train Shed and track reconstruction. CPR will remove their tracks and will replace

their tracks as agreed upon based on the contractor's accepted schedule and the requirements in the contract documents. The contractor shall coordinate construction operations with CPR's track work. Work is anticipated to be done in five stages. At least two tracks shall remain in service, and at least one of CP Rail's main lines shall remain in service except for very short interruptions from picks, lifts, or crossings that can be controlled by RR flagging.

Canadian Pacific track removal and replacement operations will only take place between April 1 and November 30 of each calendar year, weather dependant. No track work will take place over the winter. The contractor is required to submit to the engineer a detailed Critical Path Method (CPM) schedule, as described in standard spec 108.4.4, showing construction operations that can take place between Notice to Proceed and Nov 30, over the winter, and during the remaining construction periods. On this schedule, include all anticipated dates on which CP Rail forces will be needed to perform work on the site. As construction progresses, notify CP Rail of any anticipated changes in scheduled work dates for railroad forces as early as practical, but no less than 6 weeks before the actual date on which railroad work will be needed.

Preliminary coordination with Canadian Pacific Railroad has been done. Track outages on Main 1 and Main 2 are limited. Main 1 may be out of service for a single continuous time period of no longer than 4 weeks. Main 2 may be out of service for a single continuous time period of no longer than 5 weeks. These outages shall not overlap. These track closure periods include track removal time and replacement time. Removal of track and ties, and replacement of ballast, track and ties will be done by railroad forces. For each track, it is estimated that removal will take one day, and replacement will take two days.

Do not lift materials over trains. Work can take place over trains if work elements are securely attached to the structure. Track closures for overhead lifting are limited. Track closures for lifting can take place at night between the hours of 2300 and 0500. Night work for shed demolition is limited to 14 consecutive or non-consecutive nights within a 21 consecutive calendar day period in Stage 1. Night work for erecting the trusses, roof material, and mezzanine is limited to 28 consecutive or non-consecutive nights within a 40 consecutive calendar day period in Stage 4.

Propose track closures to the Canadian Pacific Railroad and Amtrak for approval as described in the article for Traffic Control and Construction Staging.

Work performed by CPR will include removal of rail, ties, ballast and other track materials for Tracks 0, 1, 2, and 3 over the tunnel; Track 0 over the proposed storm sewer; and Track 4 within the shed and 100 feet west to provide access route. It will also include track relocation and resurfacing as shown in the track plans included in the bid documents, and installation of all grade crossings. Grade crossing approaches and bases are the responsibility of the contractor.

Have the tunnels, platforms and other work under tracks complete, backfilled, and ready for placement of ballast, track and ties, to allow CPR to return the track to service by the time of scheduled work by railroad forces. This work shall be coordinated with the CPR. In the event that trains run on the track, shoring able to withstand Coopers E-80 loading will be required

Perform the work described herein as work performed by the department (STATE). Work to be performed by the department (STATE) and Canadian Pacific Railway (COMPANY) shall be phased and timed as follows, unless otherwise agreed by the parties:

Stage 1 Work by COMPANY:
Contractor shall notify the COMPANY 30 days in advance of required work for Stage 1 work by COMPANY. The COMPANY will remove track 4 from within the Shed and 100 feet west of the shed. Full track closures are anticipated for night work for demolition. See restrictions on night work and full track closures as noted above. The COMPANY will notify the STATE of completion of the work 48 hours in advance of that time.

Stage 1 Work by STATE:
The STATE will demolish the existing train shed. Full track closures are anticipated. See restrictions on night work and full track closures as noted above. Contractor shall notify the COMPANY of the anticipated end of Stage 1 four weeks in advance of that date.

Stage 2a Work by COMPANY:
The COMPANY will close track 0 and remove portions of track 0 over the existing tunnel and over the area of proposed storm sewer construction. The COMPANY will install temporary pedestrian grade crossings across tracks 0 and 1 for passenger access to platform 2, and permanent grade crossings at final grade at east and west ends of proposed platform 1. Relocation of temporary grade crossings may be necessary to accommodate reconstruction of the platform from east to west. The COMPANY will notify the STATE of completion of the work 24 hours in advance of that time.

Stage 2 Work by STATE:
The STATE will construct new foundations below platform 1, reconstruct portions of the existing south depot wall and entrance, reconstruct platform 1, install track drain, install storm sewer under track 0, and reconstruct the tunnel and stairs north of and under track 0. Contractor shall notify the COMPANY of the anticipated required date for removal of a portion of track 1 four weeks in advance of that date.

Stage 2b Work by COMPANY
The COMPANY will close track 1 and remove a portion of track 1 over the existing tunnel. The COMPANY will notify the STATE of completion of the work 24 hours in advance of that time.

Stage 2b Work by STATE:
The STATE will reconstruct the tunnel roof under track 1, the north edge of platform 2, and install track drain. Contractor shall notify the COMPANY of the anticipated date for reinstating tracks 0 and 1 four weeks in advance of that date.

Stage 2c Work by COMPANY:
The COMPANY will reinstate tracks 0 and 1 and resurface tracks to final proposed elevations.

Stage 3a Work by COMPANY:
The COMPANY will close tracks 2 and 3 and remove portions of tracks 2 and 3 over the existing tunnel. The COMPANY will notify the STATE of completion of the work 24 hours in advance of that time.

Stage 3a Work by STATE:
The STATE will construct new foundations below platform 2, reconstruct the south edge of platform 2, install track drain, and reconstruct the tunnel roof near and under track 2. Contractor shall notify the COMPANY of the anticipated date for reinstating track 2 four weeks in advance of that date.

Stage 3b Work by COMPANY:
The COMPANY will reinstate track 2. The COMPANY will notify the STATE of completion of the work 24 hours in advance of that time.

Stage 3b Work by STATE:
The STATE will construct new foundations below platform 3, remove platform 3, reconstruct the remaining tunnel and stairs, construct new shed column footing pedestals and columns, install track drains and storm sewer, and place base aggregate for platform 3.

Stage 4 Work by STATE:
The STATE will erect the new shed and mezzanine. Full track closures are anticipated. See restrictions on night work and full track closures as noted above. The STATE will complete construction of platform 3 and track drains. Contractor shall notify the COMPANY of the anticipated date for reinstating track 3 four weeks in advance of that date.

Stage 4 Work by COMPANY:
The COMPANY will reinstate track 3, resurface tracks 2 and 3 to final elevations, and install grade crossings for tracks 2 and 3. The COMPANY will notify the STATE of completion of the work 24 hours in advance of that time.

Stage 5 Work by STATE:
The STATE will complete shed construction and finishing work. Contractor shall notify the COMPANY of the anticipated date for reinstating track 4 four weeks in advance of that date.

Stage 5 Work by COMPANY:
The COMPANY will reinstate track 4 in its finished location and profile, and install grade crossing for track 4.

Amtrak
Amtrak passenger service at the station will continue throughout the construction period. Passenger access to designated platforms in service shall be coordinated with Amtrak. Provide a passenger routing plan to Amtrak as noted in the Special Provision for Traffic Controls and Construction Staging. Provide temporary fence, barriers, doors, walls, signage, ADA compliant hard walking surfaces across construction areas, and connections to temporary grade crossings to facilitate passenger access between the station building and the platform. Temporary grade crossings will be installed by CP Rail.

It is anticipated that platforms in service or adjacent to tracks in service will be used for access of construction workers and small construction vehicles, such as rubber tire personnel lifts. Such access shall be coordinated with CPR and Amtrak, with work stopping as required to conform to railway and other safety requirements.

5. Traffic Control and Construction Staging.

Submit staging plans for maintaining freight and passenger rail train service and passenger access to platforms through the project limits to the department and railroad(s) for approval prior to commencing work or changing stages. Four weeks prior to commencing work or changing stages, notify the railroad companies and submit a detailed staging plan for maintaining freight traffic through the shed and passenger access to the active platforms. All temporary passenger routes shall be ADA compliant and meet MUTCD guidelines. Safety of the public is of the upmost importance and is the responsibility of the contractor. Work will not be allowed above passengers, and passenger routes shall be clearly separated from work zones. Payment for temporary facilities for passenger routing including fencing, screening, walls, doors, pavement, pavement transitions, walkways, signage, will be included in the cost of Traffic Control. Payment for track protection, temporary shoring, temporary haul roads, and other work required for construction staging is included in the cost of other bid items associated with the project. Payment for staging plan submittal, approval, and review is included in the cost of other bid items associated with the project.

Submit traffic control plans to the engineer for work impacting roadway traffic flow and parking areas. Obtain all necessary permits required for work impacting public roadways and areas. Payment for traffic control plan and permits is included in the cost of Traffic Control.

If temporary removal or disruption of existing facilities, structures, pavements, etc. is needed for staging material or equipment, obtain permission from the owner before doing that work. Prepare a plan documenting how facilities will be protected, removed and replaced, and/or restored after construction for approval by the engineer. Payment for

temporary facility removal or disruption plan submittal, approval, and review is included in the cost of other bid items associated with the project.

6. Holiday Work Restrictions.

Do not perform work on, nor haul materials of any kind along or across any portion of the highway carrying St. Paul Ave. and interstate highway 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, and do not interfere with or interrupt passenger movement between trains, platforms, and the depot along approved access routes during the following holiday periods:

- From noon Thursday, July 3, 2014 to 6:00 AM Monday, July 7, 2014 for Independence Day;
- From noon Thursday, August 29, 2014 to 6:00 AM Tuesday, September 2, 2014 for Labor Day;
- From noon Wednesday, November 26, 2014 to 6:00 AM Monday, December 1, 2014 for Thanksgiving;
- 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, Sept 4 to 6:00 AM Tuesday, Sept 8, 2015 for Labor Day.

7. Railroad Insurance and Coordination.

A Description
Comply with standard spec 107.17 for all work affecting Soo Line Railroad Company, d/b/a Canadian Pacific Railway Company property and any existing tracks.

A.1 Railroad Insurance Requirements
In addition to standard spec 107.26, provide railroad protective liability insurance coverage as specified in standard spec 107.17.3. Insurance is filed in the name of Soo Line Railroad Company, d/b/a Canadian Pacific Railway Company.

Notify evidence of the required coverage, and duration to Edward Oom at 11306 Franklin Avenue, Franklin Park, IL 60131. Include the following information on the insurance document:

Project 1000-40-70
Route Name Milwaukee Intermodal Station
C&M Subdivision
Milepost 85.46 – 85.91

A.2 Work by Railroad
The railroad will perform the work described in this section, except for work described in other special provisions and will be accomplished without cost to the contractor. Description of work by railroad is included in other special provisions.

A.3 Names and addresses of Railroad Representatives for Consultation and Coordination
Contact Edward Oom, Manager Public Works, 11306 Franklin Avenue, Franklin Park, IL 60131; TELEPHONE (630) 701-5882; email oom0001@cpr.ca for consultation on railroad requirements during construction.

Contact CP(SOO) prior to letting for flagman work hour availability.

Amend standard spec 108.4 to include the railroad in the distribution of the initial bar chart, and monthly schedule updates. The bar chart shall specifically show work involving coordination with the railroad.

A.4 Temporary Grade Crossing
If a temporary grade crossing is desired, submit a written request to the railroad representative named in A.3 several weeks prior to the time needed. Approval is subject to the discretion of the railroad. The department has made no arrangements for a temporary grade crossing.

A.5 Train Operation
Approximately 16 passenger trains and 14 through freight trains operate daily through the construction site. Passenger trains operate at up to 15 mph. Through freight trains operate at up to 10 mph.

A.6 Temporary Clearances During Construction
Replace subparagraphs (3) 4.1 and (3) 4.2 of standard spec 107.17.1 with the following:

> Provide 10 feet 0 inches (2.74 m) plus 1.5 inches (38 mm) per degree of track curvature, measured horizontally from the track center line.
>
> Provide 21 feet 0 inches (6.4 m) plus compensation for super-elevated track, measured vertically above the top of the highest rails.

B Railroad Flagging
Arrange with the railroad for the flagging of trains and safety of railroad operations when working between the clearance fences specified. The following conditions may also warrant flagging:

1. Cranes swinging or handling materials or equipment between clearance fences.
2. Construction operations that are in proximity of power lines or railroad signal and communication lines, underground cables, fuel oil facilities or pipe lines and which might result in fire or damage to such facilities, danger to railroad operations or danger to the public in the transaction of business on railroad premises.
3. Excavation, tunneling, blasting, pile driving, placing, or removing cofferdams or sheeting, or similar activities might cause the railroad's tracks or buildings to be undermined, heaved out of normal level, shifted out of alignment, or otherwise impaired.
4. Bridge painting activities including rigging of falsework, scaffolding or similar activities between clearance fences.
5. Deck removal activities between clearance fences.
6. Pouring of bridge decks in spans over an operated track.
7. At any other time in railroad representative's judgment, the contractor's work or operations constitute an intrusion into the track zone and create an extraordinary hazard to railroad traffic, and at any other time when flagging protection is necessary for safety to comply with the operating rules of the railroad.

Projects with concurrent activity may require more than one flagger.

Projects with heavy contractor activity between clearance fences or unusual or heavy impact on railroad facilities will normally require a full-time flagger.

The department and railroad will monitor operations for compliance with the above flagging requirements. Violations may result in removal from railroad property until arrangements to adhere to the flagging requirements are satisfied. If the railroad imposes additional flagging requirements beyond the above flagging requirements due to the previous violations, the contractor shall bear all costs of the additional flagging requirements.

C Flagging by Railroad– Railroad Does Not Pay Flagging Costs

C.1 General

Replace paragraph (3) of standard spec 107.17.1 with the following:

Comply with the railroad's rules and regulations regarding operations on railroad right-of-way. If the railroad's chief engineering officer requires, arrange with the railroad to obtain the services of qualified railroad employees to protect railroad traffic through the work area. Bear the cost of these services and make payment directly to the railroad. Notify the appropriate railroad representative as listed in section A.3 above, in writing, at least five business days before starting work near a track. Provide the specific time planned to start the operations.

Extended Duration Work or Longer Work Day (to be used when requiring a flagger for longer periods of time, 4-weeks or more, or working longer than an 8-hour work day): Work that requires railroad flaggers to occupy the work zone for longer duration or longer than the normal work day will require 40 day written notice to the railroad.

Track Clearance Fence:
Upon written notification from the railroad, the contractor may erect track clearance fence along the track between the track and the work zone, as directed by the flagger to minimize the need for flagging. The contractor may not cross this fence with their activities, including booms and other swinging objects.

C.2 Rates – Canadian Pacific (Soo Line)
The following rates, reimbursement provisions, and excluded conditions will be used to determine the contractor's cost of flagging:

$750 daily rate for an eight-hour day (including wages, labor surcharges, meals, lodging, vehicle and mileage expenses),

$1,100 daily rate for an eight-hour day on Saturdays, Sundays or holidays (including wages, labor surcharges, meals, lodging, vehicle and mileage expenses),

$135 per hour overtime rate for all time worked before or after the regular assigned eight hours on any day, or for a minimum three hour call on Saturdays, Sundays, or Holidays.

If a flagger must be relieved due to hours of service requirements, arrangements will be made for a relief flagger.

The flagger is required to set flags each day in advance of the contractor commencing work that will require flagging. The flagger must also remove the flags each day after the completion of work that required flagging. Any time worked before or after the minimum eight-hour flagging day to set or remove flags will be billed at the overtime rate. The contractor is responsible for knowing the requirements of the railroad for arranging and terminating flagging services and for the associated costs of those services.

C.3 Reimbursement Provisions
The actual cost for flagging will be billed by the railroad. After the completion of the work requiring flagging protection as provided in section B above, the department will reimburse 50% of the cost of such services up to the rates provided above based on paid railroad invoices, except for the excluded conditions enumerated below. In the event actual flagging rates exceed the rates stated above, the department will reimburse 100% of the portion of the rate that is greater than the rates stated above.

C.4 Excluded Conditions
The department will not reimburse any of the cost for additional flagging attributable to the following:

1. Additional flagging requirements imposed by the railroad beyond the flagging requirements provided in subsection B above due to violations by the contractor.
2. Temporary construction crossings arranged for by the contractor.

The contractor shall bear all costs of the additional flagging requirements for the excluded conditions.

C.5 Payment for Flagging
Railroads may issue progressive bills. Notify the railroad when the work is completed and request a final bill from the railroad. The railroad will issue a final bill. Promptly pay railroad-flagging bills, less any charges that may be in dispute. The department will pay for flagging reimbursement under the Railroad Flagging Reimbursement administrative item. The department will withhold flagging reimbursement until any disputed charges are resolved and the final bill is paid. No reimbursement for flagging will be made by the department if a violation of subsection B is documented.

D Rail Security Awareness and Contractor Orientation
Prior to entry on railroad right-of-way, the contractor shall arrange for on-line security awareness and contractor orientation training and testing, and be registered through "e-RAILSAFE" for all contractor and subcontractor employees working on railroad right-of-way. See e-railsafe.com "Information". The security awareness and contractor orientation training is shown under the railroad's name. The department has secured right of entry to railroad property; neither the contractor nor subcontractors or their employees will be required to sign a right-of-entry form. The security awareness and contractor orientation certification is valid for one year(s) and must be renewed for projects that will carry over beyond the one year period. Contractor and subcontractor employees shall wear the identification badge issued by e-RAILSAFE when on railroad right-of-way. Costs associated with training and registration are incidental to other items in the contract.
107-034 (20130615)

8. Utilities.

This contract **does not** come under the provision of Administrative Rule Trans 220.

There are underground and overhead utility facilities located within the project limits. There are known utility adjustments required for this construction project. Coordinate construction activities with a call to Diggers Hotline or a direct call to the utilities that have facilities in the area as required per statutes. Use caution to ensure the integrity of underground and overhead facilities.

Some utility work, as described below, is dependent on coordination with the contractor during construction. Provide the engineer and the affected utility a good faith notice of when the utility is to start work at the site. Notice shall be given 14 to 16 calendar days in advance of when the site will be available to the utility. Follow up with a confirmation notice to the engineer and the utility not less than 3 working days before the site will be ready for the utility to begin its work.

Prospective bidders are cautioned that the arrangements set forth in this article represent the utility companies' best estimate of their plans to relocate and/or adjust conflicting facilities. Frequently, the utility companies encounter problems that prevent them from meeting their anticipated schedules. 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 within the project work limits.

All contractors' equipment must maintain the minimum OSHA clearance from overhead facilities as described in OSHA's guidelines for clearances. All contractors should incorporate any additional costs associated with working around existing overhead facilities into their bid, as the respective utilities believe they do not impose any direct conflicts with the scope of this project.

American Transmission Company (ATC) owns overhead high voltage electrical transmission lines near the eastern and western project limits outside of the work area. No conflicts with transmission lines are anticipated, however the OSHA safe working clearance shall be maintained at all times when working under or near the utility. The ATC contact person is Chris Dailey at (262) 506-6884 work or (414) 651-3950 cell.

AT&T owns and operates facilities within the project limits as follows:

Telephone facilities will be removed within the existing train shed building as part of this project's contract. An existing telephone service currently maintained by AT&T will be abandoned at Station 39+50 as part of this contract during construction. Use caution when working around AT&T's facilities. The AT&T contact person is John Bulanek at (414) 535-7407.

CP Rail owns and operates fiber optic and electrical facilities along the railroad tracks within the project site. Work to these facilities will be performed during construction as part of the project contract package. The CP Rail contact person is Edward Oom at (630) 860-4975 office, (630) 701-5882 mobile.

City of Milwaukee owns and operates sanitary sewer, water, and street lighting along St. Paul Avenue near the project site. No conflicts are anticipated with the City of Milwaukee facilities. The City of Milwaukee contact person is Zafar Yousuf at (414) 286-2467.

Milwaukee Metropolitan Sewerage District (MMSD) owns and operates facilities near the project site along St. Paul Avenue. No conflicts are anticipated with the MMSD's facilities. The MMSD contact person is Debra Jensen at (414) 225-2143.

Time Warner owns and operates facilities near the project site along St. Paul Avenue. No conflicts are anticipated with Time Warner facilities. The Time Warner contact person is Steve Cramer at (414) 277-4045.

We Energies (Electric) owns underground electric facilities within the project limits. Underground electric feeds an existing electrical transformer located at the southwest corner of the train shed and crosses beneath the tracks and platforms at approximately Station. 41+00. Modifications to the existing electrical facilities and transformer will be required during project construction by We energies personnel. Notice shall be given 14 to 16 calendar days in advance of when the site will be available to the utility. Follow up with a confirmation notice to the engineer and the utility not less than 3 working days before the site will be ready for the utility to begin its work.

It is imperative that the contractor contact We Energies before removing any underground cables, to verify they have been abandoned and carry no electrical current. The contractor must not assume that unmarked facilities have been abandoned. At no time is it acceptable to push, pull, cut or drill an unmarked facility without explicit consent from We Energies. The contractor must call We Energies 24 hour Dispatch lines to arrange for this verification. We Energies Electrical Dispatch number: (800) 662-4797.

The We Energies (Electric) field contact person is Ken Franecki at (414) 944-5531.

We Energies (Gas) owns underground facilities near the project site along St. Paul Avenue. We Energies anticipate their facilities will not be in conflict and will remain in place.

It is imperative that the contractor contact We Energies before removing any underground facilities to verify they have been abandoned. The contractor must not assume that unmarked facilities have been abandoned. At no time is it acceptable to push, pull, cut or drill an unmarked facility without explicit consent from We Energies. The contractor must call We Energies 24 hour Dispatch lines to arrange for this verification. We Energies Gas Dispatch number: (800) 261-5325.

The We Energies (Gas) contact person is Tom Minesal at (414) 944-5755.

We Energies (Steam) owns underground facilities near the project site along St. Paul Avenue. We Energies has a steam facility in the general area of Station 52+00.00 and anticipate their facilities will not be in conflict and will remain in place.

It is imperative that the contractor contact We Energies before removing any underground facilities to verify they have been abandoned. The contractor must not assume that unmarked facilities have been abandoned. At no time is it acceptable to push, pull, cut or drill an unmarked facility without explicit consent from We Energies.

The We Energies contact person is Paul Hubbard at (414) 221-2391.

Railroad Fiber Optic Lines
Soo Line Railroad Company Fiber Optic Lines
Call “Diggers Hotline” and additionally contact the Canadian Pacific Railway “call before you dig” office at least three working days in advance of beginning work. Verify the locations of Canadian Pacific owned fiber optic and railway signal cables located on railway right-of-way. Call (866) 291-0741 between the hours of 6:00 AM to 6:00 PM,

Mountain Time, Monday through Friday, except holidays referencing Railway Mile Post 85.33 through 85.92 on the C&M Subdivision, Wisconsin, to verify the location of fiber optic lines located on railroad right-of-way at the construction site. Calls will be routed at all times in case of an emergency.

Candian Pacific (Soo Line) owns underground switch and signal cable throughout the project. Canadian Pacific does not anticipate conflicts with their facilities. Call CP one call number (866) 291-0741 to ensure existing facilities are marked. Contact Canadian Pacific Railway at least 7 days prior to the start of work that may impact underground switch or signal cable facilities. In the event conflicts arise during construction, coordinate with Canadian Pacific for them to perform relocations. Engineering approvals will be required by Canadian Pacific Railway for all relocation activities and are estimated to take one week to complete.

The Canadian Pacific Railway construction contacts are Eddie Castillo (773) 350-4670 and Ed Serdynski, (262) 895-2415.

9. Work by Others, United States Postal Service.

The United Stated Postal Service (USPS) will be performing work to relocate existing vent pipes near the NE corner of the Train Shed. Coordinate with Mr. Tom Barbian of the USPS at least 60 days prior to demolition of the concrete screen walls and shed columns in the NE corner of the shed.

Mr. Tom Barbian
Manager Maintenance Department
Milwaukee GMF/VMF
PO Box 5042
Milwaukee WI 53201-5042
(414) 270-2365
thomas.a.barbian@usps.gov

10. Work by Others, Charter Manufacturing.

Charter Manufacturing stores railroad cars on Track 4 under the shed. Charter Steel will perform work to remove and reinstall their electrical services along track 4 during construction. Coordinate with Mr. Mark Kaslow at least 60 days prior to removal of Track 4.

Mr. Mark Kaslow
Chief Mechanical Officer
Charter Manufacturing
PO Box 183
Milwaukee WI 53201
(414) 640-7669
kaslowm@chartermfg.com

11. Notice to Contractor, Asbestos Abatement.

Mr. Steven Marcinkowski, License Number AII-106015, and Mr. Bruce Benoit, License Number AII-110003 inspected the train shed structure located located at 433 W. St. Paul Avenue, Milwaukee, Wisconsin for asbestos on August 23 and 24, 2007. Regulated Asbestos Containing Material (RACM) was identified on this structure as described in the report entitled "Pre-Renovation/Demolition Asbestos Inspection Report, Milwaukee Intermodal Station – Train Shed. 433 West St. Paul Avenue, Milwaukee, Wisconsin" prepared by Sigma Environmental Services, Inc. and dated September 2007.

Mr. Dale Armbruster, License Number AII-156285 performed a limited inspection of the brick shed along the rail tracks west of the Milwaukee Intermodal Station train shed structure located at 433 W. St. Paul Avenue, Milwaukee, Wisconsin for asbestos on May 28, 2013. Regulated Asbestos Containing Material (RACM) was identified on this structure as described in the letter with the subject line of "Limited Pre-Renovation Asbestos Inspection, Brick Storage Shed, Milwaukee Intermodal" prepared by Sigma Environmental Services, Inc. and dated June 7, 2013.

In accordance to NR447, ensure that WDNR receives a completed Notification of Demolition and/or Renovation, WDNR Form 4500-113, or subsequent revision, via U.S. mail or hand-delivery at least 10 working days prior to beginning any construction or demolition. All associated fees will be paid by the contractor. Also, provide a copy of the completed 4500-113 form to engineer.

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

Site Name: Train shed structure,
Milwaukee Intermodal Station,
433 W. St. Paul Avenue,
Milwaukee, Wisconsin.
Site Address: 433 W. St. Paul Avenue, Milwaukee, Wisconsin.
Ownership Information: WisDOT
Contact: Michael Cape
Phone: (262) 548-5930
Age: unknown
Area: not applicable

Insert the following paragraph in Question 22:

- If asbestos not previously identified is found or previously nonfriable asbestos becomes crumbled, pulverized, or reduced to a powder, stop work immediately, notify the engineer, and the engineer will notify the department's Bureau of Equity and Environmental Services at (608) 266-1476. The department's environmental consultant will collect and laboratory analyze samples of the suspected ACM and notify engineer of results. Keep material wet until it is abated or until it is determined to be non-asbestos containing material. Remove any such material determined to be ACM under this contract.

Regulatory Requirements

All activities of contractor or contractor employees shall conform to the following regulations, and any other applicable federal, state, or local regulations:

Code of Federal Regulations (CFR), 29 CFR and 40 CFR, including but not limited to:

1. 29 CFR 1910.20
   Access to Employee Exposure and Medical Records
2. 29 CFR 1910.145
   Specifications for Accident Prevention Signs and Tags
3. 29 CFR 1910.134
   Respiratory Protection
4. 29 CFR 1910
   Toxic and Hazardous Substances (Subpart 2)
5. 29 CFR 1910.120
   Hazardous Communications Regulations
6. 29 CFR 1926.1101
   Asbestos
7. 29 CFR 1926.1-.1051
   Construction Industry Safety and Health Standards (US OSHA)
8. 40 CFR PART 61
   General Provisions Subpart A and B
9. 40 CFR PART 61
   National Emission Standard Subpart M for Asbestos
10. 40 CFR 241
    Guidelines for the Land Disposal of Solid Wastes
11. 40 CFR 257
    Criteria for Classification of Solid Waste Disposal Facilities and Practices
12. EPA560/5-83-002
    Guidance for Controlling Friable ACM in Buildings

American National Standards Institute (ANSI)

1. Z9.2-79
   Fundamentals Governing the Design and Operation of Local Exhaust Systems
2. Z88.2-80
   Practices for Respiratory Protection

National Institute of Occupational Safety and Health (NIOSH)

1. Manual of analytical Methods, 2nd Ed., Vol. 1, Physical and Chemical Analysis Method (PandCAM):
2. Method 7400 Fibers (N1, 3rd Ed., Vol.1)
3. Respiratory Protection - An Employer's Manual and Respiratory Protection - A Guide for the Employee

U.S. Department of Transportation

1. CFR Title 49 - Hazardous Material Regulations
   Parts 172.101 and 173.1090

Underwriters Laboratories, Inc. (UL) Publications

1. 586-77 Test Performance of High Efficiency,
   (R 1982) Particulate, Air Filter Units

Wisconsin Administrative Code

1. Chapter NR 447 - Control of asbestos emissions
2. DNR Chapter NR 500 - General Solid Waste Management
3. Wisconsin HFS 159

Other Regulations: All other federal, state, county, municipal, and local statutes, ordinances, regulations, or rules pertaining to asbestos, including its abatement, storage, transportation and disposal; construction safety and health and hazard communication (worker right-to-know), and contractor or other licensure, certification and regulation, which are now in effect or which may come into effect prior to project completion.

Submittals

Prior to commencement of work, submit the following to the engineer:

1. Copies of notifications submitted to the Wisconsin Department of Natural Resources, Wisconsin Department of Health and Family Services, and the City of Milwaukee Department of Neighborhood Services.
2. Proof that required permits, site location and arrangements for transportation and disposal of asbestos containing waste materials have been made.
3. Documentation that contractor's employees and personnel have current Wisconsin Certification. Persons entering abatement areas shall wear certification cards in a visible place.

Upon request, submit the following to the engineer:

1. Drawings for layout and construction of decontamination enclosure systems and barriers for isolation of the work area.
2. A copy of handling procedures and list of protective equipment utilized for asbestos disposal at the landfill, signed by the landfill owner/operator.
3. Documentation that personnel have received medical monitoring as required in OSHA 29 CFR 1910.1001 (1).
4. Written respiratory protection program, which includes as a minimum, all items in OSHA 29 CFR 1910.134 (B) (1-11).
5. Manufacturer's certification that HEPA vacuums, negative pressure ventilation units and other local exhaust ventilation equipment conform to ANSI Z9.2-79.
6. When rental or borrowed equipment is used in abatement activities and to transport abatement waste, notify suppliers of equipment, including transportation, that equipment will be used in conjunction with asbestos abatement activities.

7. NIOSH approvals for all respiratory protective devices utilized on site. Include manufacturer certification of HEPA filtration capabilities for all cartridges and filters.
8. Evidence that the asbestos contractor is thoroughly familiar with federal and state EPA, OSHA, NESHAP, and other institutional requirements for removal, handling, transporting, and disposal of asbestos containing material.
9. Proof of successful completion of at least three similar projects. The proof or documentation shall include:
    a. Description of projects.
    b. Size and duration of projects.
    c. Project references.
    d. All state certification requirements as applicable.
10. Records indicating that the prospective abatement contractor has knowledge or experience in proper engineering techniques, i.e., HEPA exhausts filtration, air locks, etc. needed to contain asbestos and prevent the release of fibers.

During abatement activities, submit:

1. Job progress reports, not less than weekly, detailing abatement activities.
2. Logs documenting filter changes on; respirators, HEPA vacuums, negative pressure ventilation units.
3. Results of any bulk material analysis and any and all air sampling results conducted by contractor for OSHA compliance.
4. Results of material testing conducted during the abatement for purposes of utilization during abatement activities.
5. Logs documenting all persons entering and leaving decontamination suite and contained work area, including name, affiliation, certification number, and documentation of personnel protection equipment, and respiratory protection.
6. Copies of all waste manifests and test data resulting from asbestos abatement activities. Submit within thirty days after load-out, or sooner if requested by the engineer, original duplicates of the chain-of-custody forms signed by the disposal site operator evidencing acceptance of the waste ACM.
7. At completion of the work, or sooner if requested, submit to engineer two copies of personnel air monitoring data and any clearance sampling data compiled during the work. The format shall be: air monitoring form, air sampling logs, laboratory results, equipment used, and calibration data all bound in a complete packet.

Work Procedures

For all abatement projects, send written notification to Wisconsin Department of Health and Human Services in accordance to 40 CFR Part 61.146 of Subpart M, and Chapter HFS 159, Wisconsin Administrative Code, at least ten days prior to commencement of any work. Provide engineer with a copy of the Notice.

Send written notices to appropriate State and local pollution control agency responsible for enforcement of National Emission Standard for Asbestos in time frames required by law prior to the commencement of any on-site project activity in conformance with

40CFR Part 61.146 of Subpart M, Chapter NR447, Wisconsin Administrative Code, and any applicable local requirements. Provide engineer with a copy of the Notice.

Remove and dispose of asbestos containing materials in compliance with 40 CFR 61 NESHAP and NR447.

All asbestos abatement and/or removal activities shall be conducted in accordance to the EPA 40 CFR Part 763.

Have at least one on-site representative that is trained and has current Wisconsin HFS 159 Asbestos Supervisor certification. All abatement personnel must have current Wisconsin HFS 159 Asbestos Worker or Supervisor certification.

During the work, a potential exists for encountering additional asbestos materials and other hazardous materials, and for asbestos and other hazardous materials previously hidden to become exposed. Maintain a minimum of one individual on site during the work to be designated as a "Competent Person". This individual shall be familiar with applicable asbestos and hazardous materials related regulations, have the experience to recognize potential work crew and environmental exposures, institute proper personal protective equipment and personnel monitoring as necessary, and have the authority to stop work. All discoveries of suspect asbestos or other hazardous materials shall be reported immediately to the engineer so that the appropriate measures can take place.

Notify workers of presence of lead paint and take appropriate measures in accordance to OSHA laws.

It is the responsibility of the contractor to provide all personal protective equipment required to maintain employee health and safety.

Personal Sampling: It is the responsibility of the contractor to perform personal air sampling as required under OSHA 29 CFR 1926.1101.

Hygiene Facilities: Provide adequate decontamination facilities for their employees as required by federal and state regulations.

Containment: All work areas must be fully contained to prevent asbestos fiber migration. Containment shall be performed in accordance to recognized industry practices and all applicable federal, state and local regulations. Air within containment must be changed a minimum of four times per hour. All exits and entrances must be posted with the required OSHA danger sign.

Air Pressure Differential: All work areas must be under negative pressure, using air filtration units equipped with HEPA filters. All HEPA filters must be certified by the manufacturer to have an efficiency of not less than 99.97 per cent. All exhausts from the HEPA filtration system must be vented to the outside air. The negative pressure system shall be tested by the contractor prior to any asbestos containing material being wetted or

removed. Ensure that all work areas are maintained under constant negative pressure until final clearance is achieved.

Filter Changes: Air filtration unit filters must be changed as needed to maintain the pressure specified by the manufacturer. A log of filter changes shall be maintained by the contractor.

Removal: Asbestos-containing materials must be removed using wet methods in accordance to federal, state and local regulations. Material shall be wetted before removal begins, maintained wet during removal, and kept adequately wet until final disposal at the approved landfill. Abatement activities shall be conducted in accordance to recognized industry standards and applicable federal, state and local regulations.

Perform asbestos removal work in accordance to 29 CFR 1926.1101 and applicable State and Local regulations and as specified herein. Eating, smoking, drinking, chewing tobacco or chewing gum shall not be permitted in the regulated area. Personnel of other trades not engaged in the removal and disposal of asbestos shall not be exposed at any time to airborne concentrations of asbestos in excess of 0.01 fibers per cubic centimeter unless the personnel protection provisions of this specification are complied with by the trade personnel.

Asbestos abatement contractor is responsible for the selective demolition, removal, and temporary relocation of items (furniture, equipment, pipes, utilities, light fixtures, walls, ceilings, floors, beams, coverings, carpets, etc.) in order to complete asbestos removal activities.

If during any component removal operation a major release episode occurs, immediately notify the engineer and implement response actions in accordance to current regulations and the personnel protective provisions of this specification.

Provide warning signs at approaches to regulated areas containing airborne asbestos fibers. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.

Warning Signs: Provide warning signs that are of sufficient size (minimum 14" X 20") to be clearly legible and display the following information:

Danger
Asbestos
Cancer and Lung Disease Hazard
Authorized Personnel Only
Respirators and Protective Clothing Are Required In This Area

Site Inspection: While performing asbestos removal work, the contractor shall be subject to on-site inspection by entities including the WDNR and the local authority who may be assisted by safety or health personnel. If the work is in violation of specification

requirements or regulatory requirements, the engineer may issue a stop work order to be in effect immediately and until the violation is corrected. Standby time and expenses required to correct the violation shall be at the contractor's expense.

Following this section is a "Certificate of Visual Inspection". Complete this certification for each individual containment area or as directed by engineer. Submit completed copies to engineer.

File any Wisconsin Construction Site Emergency Response and Hazardous Chemical Reports and pay related fees in accordance to the rules of the Wisconsin Emergency Management (WEM).

Final Cleaning
Execute cleaning prior to inspection for Substantial Completion and Final Payment.

Use materials which will not create hazards to health or property, and which will not damage surfaces. Materials and methods used for cleaning shall be compatible with material being cleaned.

Final cleaning shall include, but not be limited, to the following:

1. Remove asbestos waste, debris, and materials used for asbestos removal, from buildings and site.
2. Remove temporary protection required for asbestos removal.

Final Clean-Up: Contractor is responsible for final clean-up of work area to meet established clearance levels. Practices shall include (but not be limited to) gross clean-up, visual inspection, HEPA vacuum procedures, and wet wipe procedures.

Conduct visual inspection of the work area with engineer for any remaining visible residue. Evidence of asbestos materials will necessitate additional cleaning requirements at contractor's expense.

Contractor is responsible for waste disposal at WDNR-licensed landfill with approvals to accept ACM. Waste disposal shall follow all applicable federal, state and local regulations. Submit copies of the landfill receipts to engineer prior to final payment.

Lockdown: Use of lockdown must be approved prior to use.

Monitoring and Clearance
Air Monitoring: Monitoring of airborne concentrations of asbestos fibers shall be in accordance to 29 CFR 1926.1101 and as specified herein.

Facilitate and cooperate fully with air monitoring activities, and shall take no action intended to distort or falsify measurements of fiber concentrations and shall not interfere with these air monitoring activities.

The department and/or department's Environmental Consultant may hire a firm to perform air monitoring outside of work areas and adjacent to the work areas. If these measurements indicate contamination outside of the work are from asbestos hazard abatement work, the engineer may notify the abatement contractor to immediately cease operation until the presence of contamination is verified and corrected to the satisfaction of the engineer. Resume asbestos operation only upon receiving written authorization from the engineer.

Provide air clearance monitoring for each work containment. Air clearance monitoring shall consist of collecting air samples at a rate of not more than 14 liters per minute and having a total volume of not less than 3,000 liters. Clearance samples shall be analyzed by Phase Contrast Microscopy (PCM) using NIOSH method 7400.

Department reserves the right to conduct additional air clearance monitoring of work containments to ascertain if the abatement activity meets final clearance levels.

Work containments shall meet clearance levels analyzed by Phase Contrast Microscopy (PCM) not to exceed .01 fibers per cubic centimeter.

The contractor is responsible for meeting the established clearance levels. In the event clearance levels are not met, it is the responsibility of the contractor to re-clean the area at no additional cost to the owner until such levels are met.

Payment

The cost of asbestos abatement shall be included in the cost of other demolition activities. The department will not measure and pay separately for preparing submittals; removing all asbestos; erecting, maintaining and removing temporary enclosures; monitoring; properly disposing of ACM; reporting and furnishing all necessary documentation; and for furnishing all labor, equipment, tools, materials, and incidentals necessary to complete the work in accordance to the contract.

12. Notice to Contractor, Standard Specifications for Sewer and Water Construction in Wisconsin, Latest Edition.

The Standard Specifications for Sewer and Water Construction in Wisconsin, Latest Edition can be obtained through the Public Works Industry Improvement Program at the following address:

Public Works Industry Improvement Program
2835 N. Mayfair Road
Milwaukee, WI 53222
(414) 778-1050

If there is a discrepancy or conflict between the referenced specification and the standard specifications regarding contract administration, part 1 of the standard specifications governs.

13. Notice to Contractor, City of Milwaukee Water Main Installation Specifications, Latest Edition.

The City of Milwaukee Water Main Installation Specifications, Latest Edition can be obtained through the City of Milwaukee Water Works at the following address:

Milwaukee Water Works
Zeidler Municipal Building
Room 409
841 N Broadway
Milwaukee, WI 53202
(414) 286-2830

If there is a discrepancy or conflict between the referenced specification and the standard specifications regarding contract administration, part 1 of the standard specifications governs.

14. Hauling Restrictions.

Supplement standard spec 107.2 with the following:

Five business days in advance of any proposed hauling on local streets, present the proposed haul route plan to the City of Milwaukee, to the attention of Mr. Jeffrey Polenski, (414) 286-3701. The haul route submittal shall include the months, days of the week, time of day, number of trucks, types of trucks and maximum loads of trucks anticipated to accomplish the project work.

The City of Milwaukee will review the submittal and issue a hauling permit or provide a letter with comments and proposed revisions to the contractor within five business days of its receipt. Provide copies of the approval to the engineer prior to hauling on local streets.

At all times, conduct operations in a manner that will cause a minimum of disruption to traffic on existing roadways.

15. Public Convenience and Safety.

Revise standard spec 107.8(6) with the following:

Noise levels outside the project site limits between the hours of 10:00 PM to 6:00 AM shall be restricted so as not to exceed 5dB(A) over preconstruction ambient noise levels.

Should the contractor elect to perform night-time operations, the contractor shall be responsible, at their cost, to furnish and operate sound level meters at the request of the engineer. Make noise measurements with a Type 2 or Type 1 sound level meter that complies with the metering characteristics and A-weighted network specified in Type 2, ANSI S1.4-1983 (R1997) or Type 1, ANSI S1.4-1983 (R1997) and the latest revisions

thereof. Calibrate the sound level meter with calibrator compatible with the sound level meter prior to each measurement or power on cycle.

Make noise measurements at the residential property line located closest to the source of the noise. Mount the sound level meter microphone on a tripod with the microphone located at least 5 feet above the ground. Microphone orientation shall be according to the manufacturer's recommendation for the specific sound level meter and microphone combination. Locate the microphone at least 10 feet from any walls, barriers, obstructions or sound reflective surfaces. Provide sound level measurement documentation to the engineer. If noise source is not in compliance, use the same sound level meter and calibrator for all follow-up sound level measurements.

16. Coordination with Businesses.

Arrange and conduct a meeting between the department, local officials, and affected local businesses to discuss the project schedule of operations, including vehicular and pedestrian access during construction operations. Hold this meeting prior to the start of work under this contract. Additional meetings may be held at the direction of the department if the need arises during the construction process. Coordinate scheduling meetings with the engineer and the department. Provide notice of meeting with meeting date, time, location, and agenda to businesses identified by the department or contractor who may be impacted by the project.

17. Abandoning Wells.

Amend standard spec 204.3.3.3 with the following:

Provide copies of all well abandonment forms and documentation to the department at the following address:

WisDOT BEES Hazmat Unit
Attn: Shar Te Beest
PO box 7965 , Room 451
Madison, WI 53707-7965

18. Construction Staking Structure Layout.

Amend standard spec 650.3.7 with the following:

Set additional stakes and marks as needed for correct layout of all structural, architectural, civil, drainage, electrical, and mechanical items included in project 1000-40-70.

19. Excavation, Hauling, and Disposal of Contaminated Soil, Item 205.0501.S.

A Description

A.1 General

This special provision describes excavating, segregating, loading, hauling, and treatment/disposal of contaminated soil at a WDNR-approved bioremediation facility. The nearest WDNR-approved bioremediation facilities are:

Metro RDF
10712 S. 124th Street
Franklin, WI 53132

Veolia Emerald Park
W124 S10629 S. 124th St
Muskego, WI 53150

Orchard Ridge RDF
W124 N9355 Boundary Road
Menomonee Falls, WI 53051

Perform this work in accordance to standard spec 205 and with pertinent parts of Chapters NR 700-754 of the Wisconsin Administrative Code, as supplemented herein. Per NR 718.07, a solid waste collection and transportation service-operating license is required under NR 502.06 for each vehicle used to transport contaminated soil.

A.2 Notice to the Contractor – Contaminated Soil Locations

The department and others have completed testing for soil and groundwater contamination at locations within this project where excavation is required. Results indicate that fill material impacted with petroleum and metals is present where excavation is required.

It is anticipated that no active groundwater monitoring wells will be encountered during construction. If active groundwater monitoring wells are encountered during construction, notify the engineer and protect the wells to maintain their integrity. The environmental consultant will determine if monitoring wells need to be maintained. Adjust monitoring wells that need to be maintained and do not conflict with structures or curb and gutter to be flush with the final grade. Coordinate with the environmental consultant the abandonment or adjustment of wells that conflict with the previously mentioned items and wells that are not required to be maintained.

The excavation management plan for this project has been designed to minimize the off-site disposal of contaminated material. The excavation management plan, including these special provisions, has been developed in cooperation with the WDNR. The WDNR concurrence letter is on file at the department. For further information regarding previous investigation and remediation activities at these sites contact:

Consultant:	TRC
Address:	708 Heartland Trail, Suite 3000, Madison, WI 53717
Contact:	Dan Haak
Phone:	(608) 826-3628
Fax:	(608) 826-3941

A.3 Coordination

Coordinate work under this contract with the environment consultant retained by the department's BEES:

Consultant:	TRC
Address:	708 Heartland Trail, Suite 3000, Madison, WI 53717
Contact:	Dan Haak
Phone:	(608) 826-3628
Fax:	(608) 826-3941

The role of the environmental consultant will be limited to:

a. Determining the locations and limits of contaminated soil to be excavated based on soil analytical results from previous investigations, visual observations, and field screening of soil that is excavated;
b. Identifying contaminated soils to be hauled to the bioremediation facility;
c. Documenting that activities associated with management of contaminated soil are in conformance with the contaminated soil management methods for this project as specified herein; and
d. Obtaining the necessary approvals for disposal of contaminated soil from the bioremediation facility.

Provide at least a 14-calendar day notice of the preconstruction conference date to the environmental consultant. At the preconstruction conference, provide a schedule for all excavation activities in the contaminated areas specified above to the environmental consultant. Identify the WDNR approved bioremediation facility that will be used for disposal of contaminated soils, and provide this information to the environmental consultant no later than 30 calendar days prior to commencement of excavation in the contaminated areas or at the preconstruction conference, whichever comes first.

Coordinate with the environmental consultant to ensure that the environmental consultant is present during excavation in the contaminated areas. Notify the environmental consultant at least three working days prior to commencement of excavation activities in the contaminated areas. Perform excavation work in this area on a continuous basis until excavation work is completed. The environmental consultant will be responsible for obtaining the necessary approvals for disposal of contaminated soils from the bioremediation facility. Do not transport contaminated soil offsite without prior approval from the environmental consultant.

A.4 Health and Safety Requirements
Supplement standard spec 107.1 with the following:

During excavation activities, expect to encounter soil contaminated with petroleum and metals. Site workers taking part in activities that will result in the reasonable probability of exposure to safety and health hazards associated with hazardous materials shall have completed health and safety training that meets the Occupational Safety and Health Administration (OSHA) requirements for Hazardous Waste Operations and Emergency Response (HAZWOPER), as provided in 29 CFR 1910.120.

Prepare a site-specific Health and Safety Plan, and develop, delineate and enforce the health and safety exclusion zones for each contaminated site location as required by 29 CFR 1910.120. Submit the site-specific health and safety plan and written documentation of up-to-date OSHA training to the engineer prior to the start of work.

B (Vacant)

C Construction
Supplement standard spec 205.3 with the following:

All soil required to be excavated is considered contaminated and will require off-site disposal. Control operations in the contaminated areas to minimize the quantity of contaminated soil excavated.

The environmental consultant will periodically evaluate soil excavated from the contaminated areas. The environmental consultant will evaluate excavated soil based on field screening results, visual observations, and soil analytical results from previous environmental investigations. Assist the environmental consultant in collecting soil samples for evaluation using excavation equipment. The sampling frequency shall be a maximum of one sample for every 15 cubic yards excavated.

On the basis of the results of such field-screening, the material will be designated for disposal as follows:

a. Excavation Common consisting of clean soil and/or clean construction and demolition fill (such as clean soil, boulders, concrete, reinforced concrete, bituminous pavement, bricks, building stone, and unpainted or untreated wood), which under NR 500.08 are exempt materials, or
b. Low-level contaminated material for reuse as fill within the construction limits, or
c. Contaminated soil for off-site treatment and disposal at the WDNR-licensed bioremediation facility, or
d. Potentially contaminated for temporary stockpiling and additional characterization prior to disposal.

Some material may require additional characterization prior to disposal. Provide for the temporary stockpiling of up to 100 cubic yards of contaminated soil on-site that require additional characterization. Construct and maintain a temporary stockpile of the material

in accordance to NR 718.05(3), including, but not limited to, placement of the contaminated soil/fill material on an impervious surface and covering the stockpile with impervious material to prevent infiltration of precipitation. The department's environmental consultant will collect representative samples of the stockpiled material, laboratory-analyze the samples, and advise the contractor, within 10 business days of the construction of the stockpile, of disposal requirements. The stockpiled material shall be disposed either at the WDNR-licensed disposal facility by the contractor or, if characterized as hazardous waste, by the department. As an alternative to temporarily stockpiling contaminated soil/fill material that requires additional characterization, the contractor has the option of suspending excavation in those areas where such soil is encountered until such time as characterization is completed.

Directly load and haul soils designated by the environmental consultant for offsite treatment and disposal to the WDNR-approved bioremediation facility. Use loading and hauling practices that are appropriate to prevent any spills or releases of petroleum-contaminated soils or residues. Prior to transport, sufficiently dewater soils designated for off-site treatment and disposal so as not to contain free liquids.

Based on the depth of groundwater (greater than 7 feet) reported in previous investigations and limited excavations (less than 4 feet) it is not anticipated that significant dewatering will be required. However, if dewatering is required, it shall, with pre-approval by the Milwaukee Metropolitan Sewerage District (MMSD), be discharged to the sanitary sewer. Contact MMSD at (414) 272-5100 prior to discharge of contaminated groundwater to the sanitary sewer. Furnish, install, operate, maintain, disassemble, and remove treatment equipment necessary to comply with MMSD requirements. Ensure continuous dewatering and excavation safety at all times. Provide, operate, and maintain adequate pumping equipment and drainage and disposal facilities. Notify the engineer of any dewatering activities, and obtain any permits necessary to discharge water. Provide copies of such permits to the engineer. Meet any requirements and pay any costs for obtaining and complying with such permit use. Follow all applicable legislative statutes, judiciary decisions, and regulations of the State of Wisconsin.

D Measurement

The department will measure Excavation, Hauling, and Disposal of Contaminated Soil in tons of contaminated soil accepted by the bioremediation facility as documented by weight tickets generated by the bioremediation facility.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
205.0501.S	Excavation, Hauling, and Disposal of Contaminated Soil	Ton

Payment is full compensation for excavating, segregating, loading, hauling, and treatment via bioremediation of contaminated soil; obtaining solid waste collection and transportation service operating licenses; assisting in the collection soil samples for field evaluation; temporary stockpiling of soils, if necessary; dewatering of soils prior to transport, if necessary; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.
205-003 (20080902)

20. QMP Base Aggregate.

A Description

A.1 General

(1) This special provision describes contractor quality control (QC) sampling and testing for base aggregates, documenting those test results, and documenting related production and placement process changes. This special provision also describes department quality verification (QV), independent assurance (IA), and dispute resolution.

(2) Conform to standard spec 301, standard spec 305, and standard spec 310 as modified here in this special provision. Apply this special provision to material placed under all of the Base Aggregate Dense and Base Aggregate Open Graded bid items, except do not apply this special provision to material classified as reclaimed asphaltic pavement placed under the Base Aggregate Dense bid items.

(3) Do not apply this special provision to material placed under the Aggregate Detours, Salvaged Asphaltic Pavement Base, Breaker Run, Select Crushed, Pit Run, Subbase, or Riprap bid items.

(4) Provide and maintain a quality control program, defined as all activities related to and documentation of the following:
1. Production and placement control and inspection.
2. Material sampling and testing.

(5) Chapter 8 of the department's construction and materials manual (CMM) provides additional detailed guidance for QMP work and describes required sampling and testing procedures. The contractor may obtain the CMM from the department's web site at:

http://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 standard spec 310 for each base aggregate size, source or classification, and type. Set control and warning limits based on the standard specification gradation limits as follows:

1. Control limits are at the upper and lower specification limits.
2. There are no upper warning limits for sieves allowing 100 percent passing and no lower control limits for sieves allowing 0 percent passing.
3. Dense graded warning limits, except for the No. 200 sieve, are 2 percent within the upper and lower control limits. Warning limits for the No. 200 sieve are set 0.5 percent within the upper and lower control limits.
4. Open graded warning limits for the 1-inch, 3/8-inch, and No. 4 sieves are 2 percent within the upper and lower control limits. Upper warning limits for the No. 10, No. 40, and No. 200 sieves are 1 percent inside the upper control limit.

B.6.2 Fracture

(1) Test fracture conforming to CMM 8.60. The engineer will waive fractured particle testing on quarried stone.

(2) Maintain a separate fracture control chart for each base aggregate size, source or classification, and type. Set the lower control limit at the contract specification limit, either specified in another special provision or in table 301-2 of standard spec

301.2.4.5. Set the lower warning limit 2 percent above the lower control limit. There are no upper limits.

B.6.3 Liquid Limit and Plasticity

(1) Test the liquid limit and plasticity according to AASHTO T 89 and T 90.

(2) Ensure the material conforms to the limits specified in standard spec table 301-2.

B.7 Corrective Action

B.7.1 General

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

B.7.2 Placement Corrective Action

(1) Do not blend additional material on the roadbed to correct gradation problems.

(2) Notify the engineer whenever the running average exceeds a warning limit. When 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)

21. Fence Track Clearance, Item 616.0800.S.

A Description

This special provision describes construction of a plastic fence at locations specified in the plan.

B Materials

Provide notched conventional metal "T" or "U" shaped fence posts or as approved by the engineer.

Provide fence fabric that meets 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 diamond mesh
Service Temperature:	-60° F to 200° F (ASTM D648)
Tensile Yield:	Avg. 2000 lbs per 4 feet width (ASTM D638)
Ultimate Yield:	Avg. 2900 lbs per 4 feet width (ASTM D638)
Elongation at Break (%):	Greater than 100% (ASTM D638)
Chemical Resistance:	Inert to most chemicals and acids

C Construction

C.1 Track Clearance Fences

Erect track clearance fences prior to construction work 10 feet from the near rail and on the north side of the track and/or south side of the track running continuously to separate areas of work from live tracks.

Prior to driving posts, arrange with the railroad company and utility owners to have any buried signal cable, fiber optic lines or other underground facilities located and marked where the fence is to be placed. Place the posts to avoid underground facilities.

Drive posts into the ground 12 to 18 inches, and space posts at 7.0 feet. Secure the fence at each post with a minimum of three wire ties. Weave tension wire through the top row of strands to provide a top stringer to prevent sagging.

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

Where buried facilities or subsurface conditions do not permit driving posts, support posts by some other means that will provide stability comparable to driven posts. Where posts are placed on finished platforms, construct and anchor temporary posts without damaging the finished platform surface.

D Measurement
The department will measure Fence Track Clearance in length by the linear feet along the base of the fence, center to center of posts.

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

ITEM NUMBER	DESCRIPTION	UNIT
616.0800.S	Fence Track Clearance	LF

Payment is full compensation for underground facility locating and marking services by the railroad and utility owners; furnishing and installing fence and posts; maintaining the fence and posts in satisfactory condition at all times; removing and disposing of fence and posts at the completion of the project; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.
616-050 (20050502)

22. Crack and Damage Survey, Item 999.1500.S.

A Description
This special provision describes conducting a crack and damage survey of the residences and business located at:

United States Postal Service
345 West St Paul Avenue
Milwaukee, WI 53203

This Crack and Damage Survey shall consist of two parts. The first part, performed prior to construction activities, shall include a visual inspection, photographs, and a written report describing the existing defects in the building(s) being inspected. The second part, performed after the construction activities, shall also include a visual inspection, photographs, and written report describing any change in the building's condition.

B (Vacant)

C Construction
Prior to any construction activities, thoroughly inspect the building structures for existing defects, including interior and exterior walls. Submit a written report of the inspector's name, date of inspection, descriptions and locations of defects, and photographs. The intent of the written report and photographs is to procure a record of the general physical condition of the building's interior and exterior walls and foundation. The report shall be typed on bond paper and be in text form.

The photographs shall be taken by a professional photographer capable of producing sharp, grain free, high-contrast colored pictures with good shadow details. The photographs shall be 3½ inch by 5 inch color prints, glossy, and mounted in protective storage pages with clear slip-in pockets and clear background. Each sheet shall hold four prints. The back of each photograph shall contain the following information:

ID _____
Building Location _____
View looking _____
Date _____
Photographer _____

Prior to the start of any construction activities pertinent to this survey, submit a copy of the written report and photographs to the engineer.

After the construction activities are complete, conduct another survey in the same manner, take photographs, and submit another written report to the engineer.

In lieu of photographs, a professional videographer may be hired to use a video camera capable of producing a video with the clarity required to perform this work.

D Measurement
The department will measure Crack and Damage Survey as single complete unit of work.

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

ITEM NUMBER	DESCRIPTION	UNIT
999.1500.S	Crack and Damage Survey	LS

Payment is full compensation for providing the before and after written reports, and for photographs or video.
999-010 (20130615)

23. Platform Snow Removal, Item SPV.0060.01.

A Description
This special provision describes the removal of snow from the platforms to maintain public access to passenger trains at all times based on the approved staging plan.

B Materials
Use appropriately sized equipment to remove snow in a timely fashion and in a way that does not compromise the safety of the station users or interfere with rail operations.

C Construction
After each snow event, or at least twice daily during snow event days, or as directed by the engineer, ensure that the platforms are free of snow and have good traction.

D Measurement
The department will measure Platform Snow Removal as each individual platform snow removal occurrence, acceptably completed.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.01	Platform Snow Removal	Each

Payment is full compensation for platform snow removal as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

24. Subsurface Track Drain Wrapped, SPV.0090.01; Subsurface Track Drain Unperforated, SPV.0090.02.

A Description
This special provision describes providing necessary subsurface drainage by constructing trenches, placing designated pipes or drainage devices within, and backfilling the trenches.

B Materials
Provide underdrian pipe meeting the requirements of AASHTO M252 Type S and SP.

Wrapped pipe fabric shall meet the requirements in standard spec 612.2.

C Construction
Construct in accordance to standard spec 612.3.

D Measurement
The department will measure Subsurface Track Drain (Type) by linear feet, 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	Subsurface Track Drain Wrapped	LF
SPV.0090.02	Subsurface Track Drain Unperforated	LF

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

25. Abandoning Sewer, Item SPV.0105.01.

A Description

This special provision describes abandoning existing sewer by filling it with cellular concrete in accordance to the pertinent requirements of standard spec 204 and standard spec 501, as shown in the plans, and as hereinafter provided.

B Materials

Provide cellular concrete meeting the following specifications: 1 part cement, 1 part fly ash, 8 parts sand or an approved equal, and water. Provide cement meeting the requirements of standard spec 501.2.1 for Type 1 Portland Cement. Provide sand meeting the requirements of standard spec 501.2.5.3. Provide water meeting the requirements of standard spec501.2.4.

C Construction

Fill the abandoned sewer pipe with cellular concrete as directed by the engineer. In the event that the sewer cannot be completely filled from existing manholes, tap the sewer where necessary and fill from these locations.

D Measurement

The department will measure Abandoning Sewer as a single lump sum unit of work for abandoning sewer, 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	Abandoning Sewer	LS

Payment is full compensation for furnishing all abandoning sewer as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

26. Adjusting Sewer Manhole Cover, Item SPV.0105.02.

A Description

This special provision describes the adjustment of storm manholes.

Perform this work in accordance to the pertinent provisions of the Standard Specifications for Sewer and Water Construction in Wisconsin, Sixth edition dated December 22, 2003, except as herein modified. The Standard Specifications for Sewer and Water Construction in Wisconsin is available by contacting the Public Works Industry Improvement Program, 2835 North Mayfair Road, Milwaukee, WI, or by calling (414) 778-1050.

B Materials
Adjustments shall be made using concrete adjusting rings and mortar. Adjustments may require the removal and re-installation of a new pre-cast concrete manhole cone section, with external joint wrap such as Mac Wrap or equal.

C Construction
Perform work in accordance the Standard Specifications for Sewer and Water Construction in Wisconsin. Set manhole frames to finished grade. Adjustments shall not be made using brick, stone, wood or pieces thereof. Provide type III mortar joints between frame and chimney rings. Follow SWS file No 11 and 12.

D Measurement
The department will measure Adjust Sewer Manhole Cover as a single lump sum unit of work for all manhole adjustments, 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	Adjusting Sewer Manhole Cover	LS

Payment is full compensation for furnishing all adjusting sewer manhole covers as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

27. Abandon Watermain, Item SPV.0105.03.

A Description
This special provision describes the demolition and removal of existing watermain piping, fittings, valves and all appurtenances.

B Materials
Provide materials for the Abandon Watermain item in accordance to Part VIII of the Standard Specifications for Sewer and Water Construction in Wisconsin, 6th edition, and also Chapter 4 of the City of Milwaukee Watermain Installation Specifications, Latest Edition.

C Construction
Construct in accordance to Part IV of the Standard Specifications for Sewer and Water Construction in Wisconsin, 6th Edition, and also in accordance to the City of Milwaukee Watermain Installation Specifications, Latest Edition.

D Measurement
The department will measure Abandon Watermain as a single lump sum of work for abandoning watermain, 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	Abandon Watermain	LS

Payment is full compensation for abandoning all watermain as per the plans, details, schedules, and these special provisions, including but not limited to cutting and removal of pipe and fittings and installing mechanical caps; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

28. HDPE Water Services, Item SPV.0105.04.

A Description

This special provision describes the construction of two 1½" water service laterals, 4 ground hydrants, 1 water meter and connection to interior domestic water service.

B Materials

Provide materials in accordance to City of Milwaukee Watermain Installation Specifications, Latest Edition. Water meter shall be manufactured by Badger Meter, Inc, Mueller Systems, or engineer approved equal.

C Construction

Construct in accordance to Part IV of the Standard Specifications for Sewer and Water Construction in Wisconsin, 6th Edition, and also in accordance to the City of Milwaukee Watermain Installation Specifications, Latest Edition.

D Measurement

The department will measure HDPE Water Services as a single lump sum unit of work for HDPE water services, 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.0105.04	HDPE Water Services	LS

Payment is full compensation for furnishing and installing all HDPE water services as per the plans, details, schedules and these special provisions, including but not limited to providing all required excavation, stone bedding, granular backfill and materials including sleeves, pipe, meter, valve and fittings to construct service lateral; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

29. Reinforced Concrete Platform, Item SPV.0105.05.

A Description

This special provision describes constructing a concrete pavement and tactile warning field, with reinforcement, on a prepared foundation and the associated platform yellow epoxy pavement markings.

B Materials

Materials shall be administered as set forth in standard spec 415.2, 602.2 and 646. Tactile warning fields shall be coated with yellow epoxy paint.

C Construction

Construct in accordance to standard spec 415.3, 646 and 602.3.

D Measurement

The department will measure Reinforced Concrete Platform as a single lump sum unit of work for reinforced concrete platform, 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.0105.05	Reinforced Concrete Platform	LS

Payment is full compensation for furnishing all materials and constructing concrete platform as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

30. Concrete Retaining Wall and Chain Link Fence, Item SPV.0105.06.

A Description

This special provision describes constructing a concrete retaining wall and chain link fence, on a prepared foundation.

B Materials

Furnish materials in accordance to standard spec 504.2 and standard spec 616.2.

C Construction

Construct in accordance to standard spec 504.2 and standard spec 616.3.

D Measurement

The department will measure Concrete Retaining Wall and Chain Link Fence as a single lump sum unit of work for concrete retaining wall and chain link fence, 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.0105.06	Concrete Retaining Wall and Chain Link Fence	LS

Payment is full compensation for furnishing and constructing concrete retaining wall and chain link fence as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

31. Metal Roof Deck, Section 05 30 00, Item SPV.0105.07.

A Description

A.1 General

This special provision describes the fabrication, furnishing and installation of cold-framed sheet steel roof deck spanning the full width between roof trusses as shown on the architectural and structural drawings, inferable there from and specified herein. The work includes the shop fabrication of special sections of the roof deck that require the assembly and reinforcing with rolled steel sections of deck segments and the cutting and lining with steel plate of round openings to accommodate both natural and mechanical ventilators.

A.2 Related Work Specified Elsewhere

a. Section 05 12 00 Structural Steel Framing
b. Section 05 50 00 Metal Fabrications
c. Section 07 53 00 EPDM Membrane Roofing
d. Section 07 61 00 Sheet Metal Gutters and Flashing
e. Section 09 91 00 Painting
f. Section 23 34 23 Exhaust Ventilators
g. Section 23 37 00 Gravity Ventilators

A.3 Submittals

a. Product data: Manufacturer's specifications, section properties, load tables, diaphragm shear tables, dimensions, and finishes.
b. Shop drawings showing panel placement, profiles, material thicknesses, finishes, layout, anchorage and openings as dimensioned on the structural and architectural drawings.
c. A full width sample shall be submitted as requested to verify compliance with the specifications and the level of quality.

A.4 Referenced Standards

a. Section properties shall be computed in accordance to the American Iron and Steel Institute (AISI) Specification for Design of Cold-Formed Steel Structural Members.
b. Welding shall comply with the applicable provisions of the American Welding Society (AWS) D1.3 Structural Welding Code-Sheet Steel.

c. Superimposed load and diaphragm shear capacities shall be computed in accordance to the requirements of the Steel Deck Institute (SDI).
d. The manufacturer shall have been regularly engaged in the production of roof deck and ceiling systems with all of the required features for a period of at least ten years.

A.5 Delivery, Storage and Handling

a. Roof deck shall be protected from damage during delivery, storage, and handling.
b. If storage at the jobsite is required, roof deck panels shall be elevated above the ground, sloped to provide drainage, and protected from the weather with a ventilated covering.

A.6 Coordination

a. Coordinate the fabrication of openings in the roof deck with the with the manufacturer and installer of the gravity and exhaust ventilators.
b. Coordinate the fabrication and installation of the roof deck panels with the steel roof trusses and steel skylight curbs.
c. Coordinate the fabrication and installation of the roof deck panels with the steel gutter substrate.

A.7 Quality Assurance

A.7.1 Installer Qualifications

Installer experienced in performing the work of this Section who has specialized in installations similar to that required for this project.

A.7.2 Pre-Installation Meeting

Conduct a pre-installation meeting to verify project requirements, substrate conditions and manufacturer's installation instructions.

B Materials

B.1 Manufacturers:

a. Basis of Design Product: The design of the roof deck is based on Type WP750, 36 inch wide roof deck panels as manufactured by EPIC Metals Corporation, Rankin, PA.
   Subject to compliance with the requirements, an equivalent product will be given consideration as manufactured by:
   i. Vulcraft, Division of Nucor, Charlotte, NC
   ii. Wheeling Corrugating Co., Wheeling, WV

B.2 Roof Deck Panels

a. The roof deck shall be cold-formed from 18 gage, steel coils conforming to ASTM A653, structural quality with a minimum yield strength of 40 Ksi.
b. Steel coils shall receive prior to forming a hot-dipped protective coating of zinc conforming to ASTM A924 Class G90 as defined by ASTM A653. Subsequently the galvanized sheet metal shall be coil coated with a 0.2 – 0.4 mil DFT welding compatible primer.

c. After fabrication, the exposed bottom side of the roof decking shall be coated with a factory applied intermediate coating of epoxy polyamide to be cured in ovens to provide a hard baked finish, compatible with a subsequent field applied finish coats of waterborne acrylic epoxy.

C. Construction

C.1 Fabrication

a. Roof deck shall be cold-formed by a continuous roll forming process and resistance welded to form an integral cellular unit 7.5" deep.
b. The roof deck shall have roll-formed embossments located between the longitudinal stiffening ribs in the top flanges and horizontal stiffening ribs along the vertical webs to enhance the structural performance.
c. Shallow stiffening ribs shall be roll formed into the bottom plates and located in the area between the webs to enhance the flatness of the bottom plate.
d. The manufacturer shall install structural enhancement rolled steel sections within selected deck cavities, provide additional reinforcement and the cutting and lining of circular openings in assembled deck segments to support ventilation equipment furnished and installed by others.
e. The cutting of openings for the installation of ventilation equipment where shown on the drawings shall be performed by qualified personnel in a neat and workmanlike manner.
f. The bottom surfaces of the roof deck panels shall be prime painted at the factory. Before painting, the galvanized steel shall be chemically cleaned and coated with a pre-treatment followed by a coat primer specified above.

C.2 Installation

C.2.1 General

a. The roof deck system shall be installed in strict accordance with the manufacturer's instructions, approved erection drawings and applicable safety regulations.
b. Bundles of material shall be located on the supporting structure in such a manner that overloading of any individual framing members does not occur.

C.2.2 Erection

a. Before being permanently fastened, the roof deck shall be adjusted to a final position with the ends accurately aligned and adequately bearing on the supporting trusses. Consistent coverage shall be maintained so that panels located in adjacent bays will be properly aligned.
b. The cutting of panels to suit jobsite conditions shall be performed in a neat and workmanlike manner by qualified personnel. Only those openings indicated on the structural drawings shall be cut. The cutting of field required openings must be approved by the structural engineer.
c. The roof deck shall be fastened to all supporting framing with not less than 2 - ¾". diameter puddle welds 18 " o.c. at each end of the 36" wide panels and not less than 36" o.c on the sides of panels.

d. The roof deck side laps shall be fastened together with 1 ½" long fillet welds or # 14 screws spaced not less than 36"o.c.
e. Construction loads that do not exceed the designed capacity, shall not be applied to the roof deck until after the panels are permanently fastened to supporting framing and side laps are attached, and shall not exceed the load-carrying capacity of the panels.

C.2.3 Field Quality Requirements

a. Nothing shall be suspended from the roof deck units without the specific approval from the architect and structural engineer.
b. Construction loads that could damage the roof deck such as heavy concentrated loads and impact loads must be avoided. Planking shall be used in all roof traffic areas.
c. Damaged galvanizing and other coatings must be field repaired, using appropriate methods, leaving an installation where the surfaces are clean and ready for a finish coat field painting.

D Measurement

The department will measure Metal Roof Deck as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.07	Metal Roof Deck	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

32. Cold Formed Metal Framing, Section 05 40 00, Item SPV.0105.08.

A Description

A.1 General

This special provision described the structural design, fabrication, furnishing and installation of cold-formed metal framing , including wall studs, ceiling joists, headers, runners, tracks and all accessories required for the erection of non-bearing walls and suspended ceilings as shown on the architectural and structural drawings, inferable there from and specified herein.

A.2 Framing of Walls and Ceilings

The framing of walls and ceilings shall include:

a. The substrate of the corrugated wall panel south wall.
b. The substrate of the cylindrical exterior and square interior elevator hoistway walls.

c. The substrate of the Elevator Equipment Rooms walls and ceilings and the walls under the escalators.
d. The framing of the mezzanine suspended ceiling and spandrels.

A.3 Design Framing Systems

Design framing systems to withstand design loads without deflections greater than the following:

a. Exterior Non-Bearing Walls: Lateral deflection of 1/600 of the wall height.
b. Ceiling Joists: Vertical deflection of 1/360 of the span.
c. Provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners or anchors when subject to 120 F temperature range change and accommodate lateral deflections without regard to sheathing contributions.

A.4 Fabricator

Engage a fabricator who will have undivided responsibility for engineering cold-formed metal framing by a licensed structural engineer in the State of Wisconsin and prepare design calculations, shop drawings and other structural data.

A.5 Related Work Specified Elsewhere

a. Section 05 12 00 Structural Steel
b. Section 05 50 00 Metal Fabrications
c. Section 07 41 00 Composite Metal Panels
d. Section 07 46 00 Corrugated Metal Panels
e. Section 09 21 00 Gypsum Board Assemblies
f. Section 26 05 29 Electrical Hangers and Supports
g. Section 26 05 33 Raceways and Boxes

A6. Submittals

a. Product Data: Submit manufacturer's product literature, data sheets and installation recommendations for each type of cold-formed steel framing required item
b. Structural Calculations: Submit structural calculations and drawings for al built in members related connections prepared by the cold-formed steel manufacturer for approval by the architect and Engineer of Record. Submittal shall be sealed and stamped by a licensed structural engineer registered in the State of Wisconsin
c. Description of design criteria.
d. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
e. Selection of framing components, accessories and welded connection requirements.
f. Verification of attachments to structure and adjacent framing components.
g. Structural engineer shall have a minimum of 5 years experience with projects of similar scope.
h. Shop Drawings:

i. Submit shop drawings prepared by the cold-formed steel manufacturer for approval by the architect and Engineer of Record showing plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes.
ii. Show connection details with screw types and locations, weld lengths and locations, and other fastener requirements.
iii. Submit wall panel drawings for pre-fabricated panels showing panel layout, elevation, material and location.

A.7 Applicable Publications

a. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
b. American Iron and Steel Institute (AISI):

Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)

c. American Society of Testing and Materials (ASTM):

A36/A36M(REV. A)-2003	Standard Specifications for Carbon Structural Steel
A123/A123M-2002....	Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M-2003....	Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A307-2002	Standard Specifications for Carbon Steel Bolts and Studs
A653/A653M-2003....	Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
A 780.....	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
A 1003.....	Standard Specification for Sheet Steel, Carbon, Metallic and Non-Metallic Coated for Cold-Formed Framing Members.
B 633.....	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
C955-2003.....	Standard Specifications for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
C1107-2002.....	Standard Specifications for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
C1513……	Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
E488-96	(Reapproved 2003)
.....	Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

E1190-95 ..... (Reapproved 2000)
..... Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

d. American Welding Society (AWS):
D1.3-(98) Structural Welding Code-Sheet Steel

A.8 Quality Assurance

A.8.1 Fabricator Qualifications

Fabrication shall be performed by a cold-formed steel fabricator with experience designing and fabricating cold-formed steel wall and roof deck systems equal in material, design, and extent to the systems required for this project.

A.8.2 Installer Qualifications

Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

A.8.3 Pre-installation Meeting

Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.

A.8.4 Welding Standards

Comply with applicable provisions of AWS D1.1 "Structural Welding Code—Steel" and AWS D1.3 "Structural Welding Code—Sheet Steel."

a. Qualify welding processes and welding operators in accordance to AWS "Standard Qualification Procedure."

A.9 Delivery, Storage and Handling

a. Deliver materials in manufacturer's original, unopened, undamaged containers or bundles, fully identified by name, brand, type and grade.
b. Exercise care to avoid damage during unloading, storing, and erection
c. Store materials protected from exposure to rain, snow or other harmful weather conditions, with proper ventilation to avoid condensation.
d. Store materials off the ground with sufficient bracing to avoid damage from excessive bending.
e. Protect framing members and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep joists free from dirt and foreign matter.

A.10 Project Conditions

a. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
b. During construction, adequately distribute all construction loads applied to framing so as not to exceed the carrying capacity of any one light gage steel member, or other component.

A.11 Coordination

a. Coordinate the construction of the framing for the south wall with the installation of electrical conduit.
b. Ensure that the stud web punch outs align to enable horizontal power runs serving equipment on the roof.

B Materials

B.1 Manufacturers:

a. Aegis Metal Framing LLC, Chesterfield, MO 866 902 3447
b. Dietrich Metal Framing, Joliet, IL 800 323 0746
c. Clark Western Building Systems, Rochelle, IL 800 659 0840

B.2 Galvanized Sheet Steel for studs, joists and accessories, 16 gage and heavier

Comply with ASTM A653, structural steel, zinc coated G90 with a yield of 340 MPa (50 ksi) minimum.

B.3 Galvanized Sheet Steel for studs, joists and accessories, 18 gage and lighter

Comply with ASTM A653, structural steel, zinc coated G90 with a yield of 230 MPa (33 ksi) minimum.

B4. Structural Steel Rolled Shapes and Tubing

Comply with ASTM A6, ASTM A 36, ASTM A 53.

B5. Wall Framing Steel Studs

Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, complying with Design Uncoated Steel Thickness ranging from 20 gage minimum to 12 gage as required by stud spacing and loading.

a. Flange width ranging from 1 1/4" minimum, 1 5/8" standard to 3"
b. Web Punched to manufacturer's standard shape and spacing.
c. Stud depth indicated on the drawings.
d. d.Steel track U shaped unpunched and matching steel studs.

B.6 Suspended Ceiling Framing

Comply with ASTM C 645 and ASTM C 754 Manufacturer's standard C-shaped steel joists, unpunched.

B.6.1. Wire ties

ASTM A 641, Class 1 zinc coating, sof temper 0.062 inch thick.

B.6.2 Hangers

Mild steel rods or mild steel flat hangers fastened to the side of structural members.

B.6.3 Carrying Channels

Cold-rolled steel 1 ½" deep.

B.6.4 Furring Channels
Rolled formed hat shaped sections, 20 gauge, 7/8" x 2 9/16" corrosion resistant steel.

B.7 Framing Accessories
Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33 ksi.
Provide accessories of manufacturer's standard thickness and configuration, 16gauge minimum, unless otherwise indicated, as follows:

a. Supplementary framing.
b. Bracing, bridging, and solid blocking.
c. Web stiffeners.
d. Gusset plates.
e. Deflection track and vertical slide clips.
f. Stud kickers and girts.
g. Reinforcement plates.
h. Load Bearing Headers (14 gauge minimum)

B.8 Anchors, Clips and Fasteners
B.8.1 Steel Shapes and Clips including Hold-Down Anchors
Comply with ASTM A36, zinc coated by the hot-dip process according to ASTM A123.

B.8.2 Cast-in-Place Anchor Bolts and Studs
Comply with ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.

B.8.3 Expansion Anchors
Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.

B.8.4 Power-Actuated Anchors
Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.

B.8.5 Mechanical Fasteners
Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

B.9 Requirements
Welding in accordance to AWS D1.3
Furnish members and accessories by one manufacturer only.

C Construction

C.1 Fabrication

a. Framing components may be pre-assembled into panels. Panels shall be square with components attached.
b. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.
c. Hold members in place until fastened.
d. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
    i. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    ii. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

C.2 Examination

a. Prior to installation, inspect previous work of all other trades. Verify that all work is complete and accurate to the point where the installation may proceed in strict accordance with the shop drawings.
b. Notify the architect of unsatisfactory conditions in the substrate before proceeding, Installation constitutes acceptance of existing conditions.

C.3 Erection

a. Handle and lift prefabricated panels in a manner as to not distort any member.
b. Securely anchor tracks to supports as shown.
c. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
d. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.
e. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.
f. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
g. Install headers in all openings that are larger than the stud spacing in that wall.
h. Attach bridging for studs in a manner to prevent stud and joist rotation. Space bridging rows at 4'-0" on center maximum or as shown in the Contract Documents.
i. Studs in one piece for their entire length, splices will not be permitted.
j. Provide a load distribution member at top track where loads are not located directly over bearing stud.
k. Provide temporary bracing and leave in place until framing is permanently stabilized.

l. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
m. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

C.4 Tolerances

a. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.
b. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.
c. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
d. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

C.5 Field Repair

a. Touch-up damaged galvanizing with galvanizing repair paint.

D Measurement

The department will measure Cold Formed Metal Framing as a single lump sum unit of work for cold formed metal framing, acceptably completed.

E Payment

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.08	Cold Formed Metal Framing	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

33. Metal Fabrications, Section 05 50 00, Item SPV.0105.09.

A Description

A.1 General

This special provision describes the fabrication, furnishing and installation of structural steel and stainless steel shapes, tubes and/or plates and all accessories required for the construction and erection of the following items shown on the architectural drawings, inferable there from and specified herein.

a. Platform steel signage panels framing and column connections to north shed columns and framing of signage panels along the south wall.
b. Steel service gate at the northeast corner of the shed.
c. Steel framing of elevator and elevator machine rooms
d. Electrical system steel mounting brackets extending from the skylight curbs.
e. North and southroof steel plate gutter substrate.
f. North gasket skylight steel plate gutter substrate
g. Column lights steel mounting brackets
h. Column conduit fastener steel tabs.

i. Column down spout fastener steel tabs.
j. North and southroof steel guard rails extending from the louver framing
k. Steel access stairs and bridges from the existing station roof level to the shed roof.
l. Elevator pit steel access ladders
m. South wall steel bearing angles and tubes.
n. South wall steel plate substrate closures against the Post Office Building.
o. South wall steel light valence.
p. Stainless steel post office scupper extensions within the south wall.
q. Stainless steel plate wall base at the platform level of mezzanine escalators and stairs.
r. Stainless steel escalator pits perimeter framing and ribbed plate closures to cover wells that will receive additional escalators on Platforms 2 and 3.
s. Stainless steel guard rails on escalator mezzanine landings that will receive additional escalators on Platforms 2 and 3.
t. Stainless steel guard rails under mezzanine stairs.
u. Steel safety gate at the Platform Level stair landing within the existing station.
v. Miscellaneous sections, tubes and plates required to connect to or extend from the structural frame.

A.2 Related Work Specified Elsewhere

a. Sections for Concrete Structures
b. Section 05 12 00 Structural Steel Framing
c. Section 05 30 00 Metal Roof Deck
d. Section 05 40 00 Cold Formed Metal Framing
e. Section 05 72 00 Aluminum Downspouts
f. Section 07 41 00 Composite Metal Panels
g. Section 07 46 00 Corrugated Metal Panels
h. Section 07 53 00 EPDM Membrane Roofing
i. Section 07 61 00 Sheet Metal Gutters and Flashing
j. Section 08 41 00 Aluminum Window Wall
k. Section 08 63 00 Metal Framed Skylights
l. Section 09 21 00 Gypsum Board Assemblies
m. Section 09 91 00 Painting
n. Section 10 20 00 Louvers and Vents
o. Section 10 43 00 Signage
p. Section 14 20 40 Holeless Hydraulic Elevators
q. Section 14 30 00 Heavy Duty Escalators
r. Section 26 05 29 Electrical Hangers and Supports
s. Section 26 05 33 Raceways and Boxes
t. Section 26 51 00 Luminaires
u. Section 28 31 00 Fire Detection and Alarm

A.3 Performance requirements

a. The work shall be performed by a firm specializing in Custom Metal Fabrications for a minimum of 5 years.
b. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

A.4 Standards for Architectural Metals

a. Metal surfaces which will be exposed to view: Use only materials which are smooth and free of surface blemishes.
b. Provide materials which have been cold-rolled, cold-finished, cold-drawn, stretcher leveled, machine cut and otherwise produced to the highest commercial standard for flatness, with edges and corners sharp and true to angle.
c. Metal finishes shall comply with the National Association of Architectural Metal Manufacturers(NAAMM) "Metal Finishes Manual".
d. Engage a fabricator who will have undivided responsibility for engineering by a structural engineer, licensed in the State of Wisconsin.

a. A.5 Coordination

b. Verify field dimensions before fabrication and indicate measurements on the Shop Drawings.
c. Coordinate the fabrication, installation and anchorage of the signage panels with the installation of the following items and the electrical conduit and junction boxes that will be contained by the signage panel framing:
    i. Back lighted signage panel and hinged glazing.
    ii. Recessed exit and directional signs.
    iii. Recessed light fixtures and speakers.
d. Recessed LED Information Message Displays.
e. Surface mounted Fire Alarm Audio/Visual Fixtures
f. Coordinate the installation of the main roof gutter steel substrates with Sheet Metal Gutters and Flashing and the EDPM Membrane Roofing.
g. Coordinate the installation of the north gasket skylight gutter substrate with Sheet Metal Gutters and Flashing and Metal Framed Skylights
h. Coordinate the installation of steel plate closure substrates against the Post Office Building with the construction of the Cold Formed Metal Framing, Gypsum Board Assemblies, Corrugated Metal Panels and Sheet Metal Gutters and Flashing.
i. Coordinate the Installation of stainless steel wall bases at the stairs and escalators with Composite Metal Panels.
j. Coordinate the installation of column light, conduit and downspout tabs with Structural Steel.
k. Coordinate the installation of escalator pit stainless steel plate closures and mezzanine guard rails with the concrete platform work and the escalator work.

l. Coordinate the installation of elevator pit access ladders with Holeless Hydraulic Elevators.
m. Coordinate the installation of elevator shaft and the elevator machine rooms framing with the Cold Formed Metal Framing, the gypsum board assemblies and the composite metal panel work.

B Materials

B.1 Metals

B.1.1 Steel

a. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M. When exposed use only materials smooth and free of blemishes, cold-rolled, cold-finished, cold-drawn, stretcher leveled, machine cut, with corners and edges sharp and true to angle.
    i. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
    ii. All steel exposed to the elements Zinc coated (Galvanized) or Zinc Iron Coated (Galvanealed) ASTM A 653

B.1.2 Stainless Steel

a. Stainless-Steel AISI Type 302 or Type 304 finished to Light Sandblasted Satin and protected with adhesive paper covering.
b. Stainless Steel AISI Type 316 finished to Light Sandblasted Satin for installations that abut or are embedded in concrete platforms that will be subject to salting.
    i. Plate: ASTM A 167
    ii. Bar Stock: ASTM A 276
    iii. Tubing: ASTM A 269
    iv. Sheet: ASTM 240

B.1.3 Aluminum

a. Aluminum: Clear Anodized finish AA-M10-C22-A31 to meet the requirements of AAMA 606.1, 607.1 and 608.1
    i. Extruded Structural Shapes, Alloy 6061-T6 meeting ASTM B 221
    ii. Flat Bars, Tubing and Trim Shapes, Alloy 6061-T52 meeting ASTM B 221

B.2 Welding Materials, Fasteners and Anchors

a. Welding electrodes and Filler Metal: Provide type and alloy of filler material and electrodes as recommended by the producer of metal to be welded and as required for strength and compatibility in fabricated items, after grinding welds smooth.
b. Exposed Fasteners: Flat head Phillips Head or Allen Head machine screws of the same metal as parts being fastened , countersunk flush with surface of material being fastened.
c. Fasteners for Anchoring Fabrication to Other Construction: Select fasteners of type, grade and class required to produce connections suitable and capable of withstanding imposed loads. ASTM A 307 Grade A Hot-dip galvanized ASTM A 153

B.3 Shop Primers

a. Concealed Ferrous Metal Primer (fast drying for clean smooth surfaces) FS TT P 57 Type II Zinc Chromate, Iron Oxide Alkyd Varnish:
    i. Series 90-97 Tneme-Zinc, Tnemec
    ii. M07 Universal Metal Primer, Benjamin Moore
    iii. B-59N2 Ken Kromix, Sherwin Williams
    iv. Exposed Ferrous Galvanized Metal Primer: FS TT P 641 Type II or Type III, zinc dust zinc oxide, alkyd or phenolic .
b. Series 66 or N69 Hi-Build Epoxoline, Tnemec
    i. M12 Shop Coat Metal Primer, Benjamin Moore
    ii. B 50 A 1 Galvanized Iron Primer; Sherwin Williams

B.4 Fabrication

a. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
b. Assemble steel fabrications in the shop the greatest extent possible to minimize field connections. Disassemble units only as necessary for shipping and installation.
c. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.
d. Cut, reinforce, drill and tap components as indicated to receive hardware, screws and similar fasteners.
e. Provide inserts and other anchoring devices for connecting steel fabrications to the surrounding construction.

B.5 Shop Painting

a. Prepare exterior ferrous metal surfaces to be galvanized and painted and interior surfaces to be painted to comply with SSPC-SP and with the performance requirements in FS TT-P-664.
b. Clean by "solvent cleaning" method specified in SSPC – SP 1 63 followed by "hand tool cleaning" specified in SSPC – SP 2 63 or "power toll cleaning" by method specified in SSPC – SP 3 63 to remove loose mill scale and rust. Grind rough surfaces as may be necessary to provide smooth metal surfaces. Tool cleaning and pickling may be omitted from work fabricated from cold-rolled or cold-finished stock, provided the surfaces are not heavily rusted.
c. On exposed fabrications, apply pre-treatment to inhibit corrosion and improve paint adhesion, by methods specified in SSPC – PT 2 –64 for "Cold Phosphate Treatment" or by methods specified in SSPC – PT 4 64 for "HOT Phosphate" treatment.
d. To both exposed and concealed fabrications, apply prime coat of metal primer paint as soon as possible after pre-treatment. Provide a smooth coat with uniform dry film thickness of 2.0 mils as specified above.

C Construction

C.1 Installation

a. Perform cutting, drilling, and fitting required for installing architectural metal fabrications. Set metal fabrication accurately in location, alignment, and elevation, with edges and surfaces level, plumb, true, and free of rack.
b. Fit any exposed connections accurately together to form hairline joints.
c. Anchor securely as shown or required for the intended use, using appropriate fasteners for each substrate, the intended use and load Drill holes to the exact diameter of the bolts. Thread screws full length to the head of the screw.
d. Protect finished stainless steel surfaces and paint primer finish from damage during the construction period with temporary protective coverings. Remove covering when there is no longer danger of damage from other work, yet to be performed at the same or adjacent location. Restore primer finish that may have been damage, leaving no evidence of repairs, resulting in a smooth surface , ready to receive finish coats of paint.
e. Metal fabrications shall not be more than 1/8" +/- out of plumb, within the a height of 8'-0".

D Measurement

The department will measure Metal Fabrications as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.09	Metal Fabrications	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

34. Railings and Handrails, Section 05 51 00, Item SPV.0105.10.

A Description

A.1 General

This special provision section includes all labor and materials for the fabrication, furnishing and installation of custom stainless steel railings and handrails as shown on the architectural drawings, inferable there from and specified herein.

A.2 Railings and Handrails

The railings and handrails to be installed on:

a. Along the center wall of the stair connecting Platform No. 1 the Mezzanine.
b. Free-standing, supported by posts along the center and sides of the East stair connecting Platform No. 1 to the tunnel.
c. Free-standing supported by posts along the sides of the West stair connecting Platform 1 and the tunnel.

d. Free-standing, supported by posts along the center and sides of the West stairs connecting Platform No. 2 and No. 3 to the tunnel.
e. Free-standing guard rails providing closure at mezzanine landings where an additional escalator will be installed at Platforms 2 and 3.

A.3 Railing Assemblies.

The railing assemblies shall withstand structural loads required by ASCE with minimum concentrated load of 200 pounds applied horizontally or vertically downward, but not simultaneously at any point on the top rail.

a. Handrail assembly safety performance shall comply with ASTM E 985 and ASTM E 9894 for handrail anchorage.
b. Handrail assembly metal finish shall comply with NAAMM and NOMMA manuals. Prevent galvanic action and other forms of corrosion by insulating metals from direct contact with incompatible materials
c. Components and installation are to follow ADA and ICC/ANSI A 117.1 guidelines.

A.4 Related Work Specified Elsewhere

a. Sections for Concrete Structures
b. Section 07 41 00 Composite Metal Panels

A.5 Submittals

a. Product Data: Manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.
b. Structural analysis data signed and sealed by a qualified professional engineer registered in the State of Wisconsin
c. Shop Drawings, including plans, elevations drawn to scale not less than 3"= 1'-0", showing all field connections, anchorage and accessories.
d. Samples: 6" long handrail samples to display stainless steel grade and finish.

A.6 Quality Assurance

a. Components and installation are to follow current ADA and ICC/ANSI A 117.1 requirements.
b. Provide major items of work fabricated only by a firm specializing in "Custom" type steel fabrications for a minimum of 5 years, employing only experienced tradesmen for both fabrication and installation, capable of producing work of the highest standards of quality in the industry as a. Single Source Responsibility.
c. Surface Flatness and Edges:
d. Provide materials which have been cold-rolled, cold-finished, cold drawn,, stretcher leveled, machine cut, with the highest commercial standard for flatness, with corners and edges sharp and true.
   "Structural Welding Code", AWS D1.1
   Execution tolerance +/- 5/64" (2 mm)

A.7 Delivery, Storage and Handling

a. Store handrails in a clean, dry location, away from uncured concrete and protected against damage of any kind.

b. Materials must be kept in original packing until installation.
c. Materials must be stored at not lower than – 40 °F or higher than 212° F.

A.8 Project Conditions

a. All measurements for handrails and railings must be taken from construction site elements to which railings are to fasten, and form an integral part of the shop drawings.

B Materials

B.1 Metal Handrail Materials

a. Stainless Steel: Pipe and Tubing ASTM A 269 and ASTM A 312 in an ornamental grade AISI Type 304 Satin Finish.
    i. Stainless Steel Castings: ASTM B 584
    ii. Stainless Steel Plate AISI Type 304; ASTM A 167
    iii. Stainless Steel Bar Stock AISI Type 304' ASTM A 276
b. Stainless steel cast or formed handrail brackets for installation on concrete walls.
c. Stainless steel fasteners.
d. Hydraulic Cement, ASTM C 595 factory prepared with accelerator.

C Construction

C.1 Fabrication

a. Form all changes in rail direction by radius or elbows
b. Make exposed joints butt tight and flush
c. Close exposed ends of handrail using dome end caps.
d. Locate equally spaced intermediate brackets and coordinate with the joints in Composite Metal Panels.
e. For post set in concrete, furnish matching sleeves or inserts not less than 5 inches long.
f. Locate intermediate posts, as shown on the drawings in the center line of stair treads.
g. Verify dimensions on site prior to fabrication.
h. Pre-assemble railing system prior to shipping to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly.

C.2 Installation

a. Provide information on fastening point locations for posts and brackets to the parties responsible for the railing substrates.
b. Installation shall be by the manufacturer or a qualified, authorized representative of the manufacturer
c. Installation must in full accordance with manufacturer's instructions and shop drawings.
d. Erect handrails square and level and/or parallel to the rake of stairs, free from distortion or defects detrimental to appearance or performance.
e. Provide expansion joints as needed to allow for thermal movement.
f. Any and all field welding shall be by a certified welder.

g. Maximum variation from plumb shall be 1/8"; maximum offset from true alignment for every 50 foot of railing shall be ¼" non-cumulative.
h. As installation is completed, wash thoroughly using clean water and soap and rinse with clean water. Do not use cleaning agents with abrasive or acid/alkali content.
i. Provide protective covering on all handrails if construction is not yet finished.

D Measurement
The department will measure Railings and Handrails as a single lump sum unit of work, acceptably completed.

E Payment
The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.10	Railings and Handrails	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

35. Lighted Handrail System, Section 05 52 00, Item SPV.0105.11.

A Description
A.1 General
This special provision describes and includes all labor and materials for the fabrication, furnishing and installation of custom a stainless steel slotted tube handrail system containing LED light stick inserts as shown on the architectural drawings, inferable there from and specified herein.
A.2 Lighted Handrail
a. Along the center wall of the stairs connecting Platforms No. 2 and No. 3 to the Mezzanine.
b. Free-standing, supported by posts along the center of the stair connecting Platform No. 1 to the Mezzanine.
c. Along the outer edge of the intermediate landings of the stairs connecting Platforms No.1 , No. 2 and No. 3 to the Mezzanine.

A.3 Railing Assemblies
a. The railing assemblies shall withstand structural loads required by ASCE with a minimum concentrated load of 200 pounds applied horizontally or vertically downward, but not simultaneously at any point on the top rail.
b. Handrail assembly safety performance shall comply with ASTM E 985 and ASTM E 9894 for handrail anchorage
c. Components and installation are to follow ADA and ICC/ANSI A 117.1 guidelines.

A.4 Handrail Asembly Metal Finish.
a. Handrail assembly metal finish shall comply with NAAMM and NOMMA manuals. Prevent galvanic action and other forms of corrosion by insulating metals from direct contact with incompatible materials

A.5 Related Work Specified Elsewhere

a. Sections for Concrete Structures
b. Section 07 41 00 Composite Metal Panels
c. Section 26 50 00 Lighting

A.6 Submittals

a. Product Data: Manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.
b. Structural analysis data signed and sealed by a qualified professional engineer registered in the State of Wisconsin
c. Shop Drawings, including plans, elevations drawn to scale not less than
d. 3"= 1'-0", showing all field connections, anchorage and accessories.
e. Samples: 6" long handrail samples to display stainless steel grade and finish.

A.7 Quality Assurance

a. Provide major items of work fabricated only by a firm specializing in"Custom" type steel fabrications for a minimum of 5 years, employing only experienced tradesmen for both fabrication and installation, capable of producing work of the highest standards of quality in the industry as a Single Source Responsibility.
b. Surface Flatness and Edges:
    i. Provide materials which have been cold-rolled, cold-finished, cold drawn, stretcher leveled, machine cut, with the highest commercial standard for flatness, with corners and edges sharp and true.
    ii. "Structural Welding Code", AWS D1.1
    iii. Execution tolerance +/- 5/64" (2 mm)

A.8 Delivery, Storage and Handling

a. Store handrails and lighting system in a clean, dry location, away from uncured concrete and protected against damage of any kind.
b. Materials must be kept in original packing until installation.
c. Materials must be stored at not lower than – 40 °F or higher than 212° F.

A.9 Project Conditions

a. All measurements for handrails and railings must be taken from construction site elements to which railings are to fasten, and form an integral part of the shop drawings.
b. Coordinate fabrication and installation of lighted handrails with the casting of the concrete stairs, their composite metal panel cladding and the routing of power supply conduits.

B Materials

B.1 Manufacturers

a. The design of the Lighted Handrail Systems is based on The Wagner Companies " Lumenrail" System; Butler, WI (888) 243 6914

b. Subject to compliance with the specified and detailed requirements, a comparable and equivalent product will be considered by:
c. IO Lighting, “Luxrail” System; Buffalo Grove , IL (847) 777 3900
d. HDI Railing Systems, “Circum”; Lancaster, PA (717) 285 4088

B.2 Metal Handrail Materials

a. Stainless Steel Pipe and Tubing: ASTM A 269 and ASTM A 312 in an ornamental grade AISI Type 304 Satin Finish.
b. Stainless Steel Castings: ASTM B 584
c. Stainless Steel Plate: AISI Type 304; ASTM A 167
d. Stainless Steel Bar Stock AISI Type 304; ASTM A 276
e. Stainless steel cast or formed handrail brackets for installation on concrete walls.
f. Stainless steel fasteners.
g. Hydraulic Cement: ASTM C 595 factory prepared with accelerator.

B.3 LED Light Strip Inserts

ETL listed for wet locations, standard output 70%, Life 50,000 hrs.

a. Warm white – diffused lens 64 lms. ft. in varied lengths up to 60” to suit the installation. Beam Angle 60°
b. Power supply, 24 V/100W with a consumption of 2 w/ft. Power Input 120/240 V Temperature Range: -40°F to 212°F.

C Construction

C.1 Fabrication

a. Form all changes in rail direction by radius or elbows
b. Make exposed joints butt tight and flush
c. Close exposed ends of handrail using domed end caps.
b. Locate equally spaced intermediate brackets and coordinate with the joints in Composite Metal Panels.
c. For post set in concrete, furnish matching sleeves or inserts not less than 5 inches long.
d. Locate intermediate posts, as shown on the drawings in the center line of stair treads.
e. Verify dimensions on site prior to fabrication.
f. Pre-assemble railing system prior to shipping to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly.
g. Coordinate the connection of LED Light Strip to power source with Lighting Work Section 26 50 00.

C.2 Installation

a. Provide information on fastening point locations for posts and brackets to the parties performing the substrate.
b. Installation shall be by the manufacturer or a qualified, authorized representative of the manufacturer

c. Installation must in full accordance with manufacturer's instructions and shop drawings.
d. Erect handrails square and level and/or parallel to the rake of stairs, free from distortion or defects detrimental to appearance or performance.
e. Provide expansion joints as needed to allow for thermal movement.
f. Any and all field welding shall be by a certified welder.
g. Install low voltage power supply and enclosure box for connection to 120/240 supply. Power supply to low voltage box by others.
h. Maximum variation from plumb shall be 1/8"; maximum offset from true alignment for every 50 foot of railing shall be ¼" non-cumulative.
i. As installation is completed, wash thoroughly using clean water and soap and rinse with clean water. Do not use cleaning agents with abrasive or acid/alkali content.
j. Provide protective covering on all handrails if construction is not yet finished.

D Measurement

The department will measure Lighted Handrail System as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.11	Lighted Handrail System	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

36. Metal Stair Nosings, Section 05 55 00, Item SPV.0105.12.

A Description

A.1 General

This special provision described the fabrication, furnishing and installation of abrasive cast, slip resistant safety nosings, integrally cast into the edge of all concrete stair treads and stair landings at the tunnel and mezzanine stairs as shown on the architectural drawings, inferable there from and specified herein.

A.2 Related Work Specified Elsewhere:

a. Sections on Concrete Structures

A.3 Applicable References

a. American Society for Testing and Materials (ASTM): ASTM B221Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

A.4 System Description

a. Stair nosing assemblies shall be cast-in-place with a concealed anchor.
b. Stair nosing treads shall be cross-hatched surface

c. Stair nosing tread surfaces shall be slip resistant.
d. Stair nosing treads shall meet OSHA Barrier-Free Code requirements for stair design in public buildings.

A.5 Quality Assurance

a. Obtain stair nosing assemblies through one source from an approved manufacturer.
b. Manufacturer shall be ISO 9001:2000 Certified or shall be an approved manufacturer for an ISO Certified Supplier.
c. Manufacturer shall have a minimum of 10 years of experience in the fabrication of stair nosing systems.
d. Installer: Firm with not less than 3 years of successful experience in the installation of systems similar to those required by this project and acceptable to the manufacturer of the system.

A.6 Submittals

a. Submit manufacturer's specifications and technical data, including Material Safety Data Sheets, installation instructions, as required, and catalog cuts and templates where required to explain construction and to provide for incorporation into the project.
b. Submit certificates and/or copies of independent test reports or research reports showing compliance with specified performance requirements.
c. Submit shop drawings showing complete fabrication details for all stair nosings, including required anchorage to surrounding construction.
d. Submit three 6" samples of the specified system.

A.7 Delivery, Storage and Handling

a. Prior to shipment, the manufacturer shall cover the abrasive with heavy-duty tape to eliminate concrete infiltration and staining.
b. Deliver stair nosing assemblies to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.
c. Store components in original containers in a clean, dry location.

B Materials

B.1 Acceptable Manufacturers:

a. Basis of Design Product: The design for the abrasive cast safety nosings is based on a Wooster Products Inc. system – Wooster OH (800) 321-4936. Subject to compliance with the specified and detailed requirements an equivalent product will be considered by:
b. American Safety Tread Co. – Helena AL (800) 245-4881
c. Safe T Metal Company – Syracuse NY (800) 886-7238

B.2 Stair Nosing System:

a. Abrasive cast aluminum No. 43 prime ingot, with a low copper content. "Alumogrit" with a with a crosshatched surface Type 101 safety nosing, 3" wide with # 20 virgin grain aluminum oxide integrally cast into the walking surface to a minimum depth of 1/32 inch for installation into wet concrete stair treads.
b. Concealed type anchors shall be slotted rivet type, integrally cast into the body of the nosing a minimum of 3/8 inch.. Place anchors 3" from each end and 12" o.c.
c. Cross hatching shall be 1/16" deep minimum and shall be clean and well defined.
d. Nosings shall terminate not more than 3 inches from the ends of concrete stair treads and landings. Any holes or countersinks shall be machine made and any screw heads shall not protrude above the tread or landing surface.
e. Nosings shall receive a shot blast finish.

C Construction

C.1 Examination

a. Installer shall examine conditions under which work is to be performed and shall notify the contractor in writing of unsatisfactory conditions.
b. Installer shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

C.2 Installation

a. Install stair nosings in accordance to, the industry standards applicable to the work, and the manufacturer's written installation instructions.
b. The use of very large aggregate in the concrete mix makes the placement of safety nosing difficult and should be avoided.
b. Place concrete into stair forms quickly, puddle the concrete and tamp the safety nosings to ensure proper concrete formation around the anchors.
c. Work shall be aligned plumb, level, and, where required, flush with adjacent surfaces and rigidly anchored to the substrate.

C.3 Cleaning

a. Remove protective tape as soon as practical.
b. Clean exposed surfaces as recommended by the manufacturer.

C.4 Protection

a. Permit no use of the stairs for 48 hours.
b. Establish procedures required to protect the finished work from damage by work of other Sections during the remainder of the construction period.

D Measurement

The department will measure Metal Stair Nosings as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

37. Architectural Glass Railing, Section 05 62 00, Item SPV.0105.13.

A Description

A.1 General

This special provision describes the fabrication, furnishing and installation including all field measuring of a floor fastened custom fabricated tempered and laminated glass cantilevered structural guardrail system on which will be installed stainless steel handrails as shown on the architectural drawings, inferable there from and specified herein.

A.2 The tempered glass guardrail system will be installed as:

a. The Mezzanine guardrail
b. The perimeter guardrail on the stringers and landings of the Platform to Mezzanine stairs.
c. The perimeter guardrail on the platform edges of the stair wells in the Platform to the Egress Tunnel stairs.

A.3 Related Work

a. Section 03 30 00 Cast-in-Place Concrete
b. Section 05 12 00 Structural Steel Framing
c. Section 07 41 00 Composite Metal Panels
d. Section 07 92 00 Joint Sealants

A.4 Structural Requirements

a. The structural glass guardrail assemblies shall withstand a minimum uniform load of 50 pounds per linear foot applied horizontally or vertically downward, but not simultaneously on the top rail.
b. The railing assembly shall withstand a minimum concentrated load of 200 pounds, applied in any direction at any point along the handrail system.
c. Uniform loads and concentrated loads are not applied simultaneously.

A.5 Quality Assurance

a. Components and installation are to be in accordance to the state and local building codes and follow current ADA and ICC/ANSI A 117.1 guidelines.
b. All components and fittings are furnished by the same manufacturer.
c. Furnish certification that components were installed in accordance to the manufacturer's engineering data to meet the design loads.
d. Furnish references listing project of similar size and scope.
e. Prior to the beginning of work, conduct a pre-job conference at the job site.

A.6 References

a. Guardrail assembly safety performance shall comply with ASTM E 2358 and ASTM C 1048 and C 1172 for glass in guardrails,
b. Stainless Steel Handrails shall comply with ASTM A 312.
c. Guardrail assembly metal finish shall comply with NAAMM and NOMMA manuals.

A.7 Submittals

a. Product Data; Manufacturer's technical data for railing components and accessories.
b. Shop Drawings: Dimensioned drawings of railing assemblies indicating plans, elevations and sections of:
    i. Railings, handrails, brackets, reinforcements, anchors, welded and bolted connections.
    ii. Provide setting diagrams for installation of anchors, location of pockets, weld plates for attachment of rails to structure.
    iii. Indicate component details, materials, finishes, connections and joining methods and the relationship to adjoining work.
    iv. Certification or calculation by an engineer registered in Wisconsin, showing the safety requirements are met.
c. Samples: Duplicates of railing and glass showing finish.
d. Manufacturer's installation and maintenance instructions.

A.8 Delivery, Storage and Handling.

a. Deliver materials properly protected against damage to finished surfaces during transit.
b. Store material under cover in a dry location, with any stacking in a way that will prevent bending. Cover with waterproof paper, tarpaulin in a manner that will permit the circulation of air inside the covering.
c. Unless minor defects can be made to meet the architect's specifications, damage parts must be removed and replaced.

B Materials

B.1 Manufactures

a. The design of the Architectural Glass Railing Systems is based on C.R. Laurence Co, Inc. "Taper-Loc System" – Los Angeles, CA 800 421 6144. Subject to compliance with the requirements, an equivalent product by one of the following manufacturers will be considered:
b. The Wagner Companies, Butler, WI (888) 243-6914
c. Julius Blum, Carlstadt, NJ (800) 526-6293

B.2 Materials

a. Fully tempered laminated glass ASTM C 1048 and ASTM C 1172 Kind FT quality q3 clear glass conforming to the requirements of ANSI Z97.1 with a PVB interlayer.
b. Structural tempered and laminated glass guardrail shall be 1 1/16" inch thick.

c. Top and side edges of glass guardrail shall be eased and polished.
d. Extruded aluminum clear anodized 6063-T52 U shaped shoe base molding anchored to the floor substrate to accept within the glass pocket the guardrail panel with a dry glazing system consisting of the plastic fittings that grip and secure the glass mechanically.
    i. Shoe Base Profile L 25S 10 D – 4 ¾" x 3 3/8"
e. Dry Glazing System consisting on two (2) Taper Shims and one L- Pressure Block.
f. Black rubber gasket to seal the glass pocket.
g. For steel attachment: profiles conforming to ASTM A 36 , with anchoring devices sizes drilled and tapped for fastener types and spacing indicated in the shop drawings. Hole size in the base show to be 9/16" , counter bore 7/8" x depth ½" and 12" center to center spacing of holes. Use ½" – 13X stainless steel socket head cap screw.
h. Handrail Brackets and Tubing: Cast and machined Stainless Steel ASTM B 584 for 1 ½" diameter round handrail tubing ASTM A 269 and ASTM A 312 in an ornamental grade for laminated glass guard rail installation AISI satin finish.
i. Fasteners: All mechanical fasteners used in the assembly shall be stainless steel.

C Construction

C. 1 Fabrication

a. Shop cut all glass panels, leaving +/- 1/8 open joints and coordinate pre-drilling to accept handrail brackets.
b. Ease exposed glass edges by grinding and polishing.
c. Configure the hole spacing in aluminum shoe to coincide with guardrail steel substrate.
d. Fabricate handrail assembly components to lengths and configurations complying with the contract documents and reviewed shop drawings.
e. Machine joint edges smooth and plane to produce hairline seams when site assembled. Supply concealed sleeve connectors for joints. Close exposed ends of handrails with appropriate end caps.
f. Isolate dissimilar metals to prevent electrolytic action by applying primer to concealed surfaces of metal components.
g. Paint aluminum surfaces in contact with concrete, with water-white methacrylate lacquer.

C.2 Installation

a. Erect guardrails square and level and/or parallel to the rake of stairs, free from distortion or defects detrimental to appearance or performance.
b. Provide expansion joints as needed to allow for thermal movement

C.3 Cleaning and Repair

a. As installation is completed, was thoroughly using clean water and soap and rinsing with water.
b. Do not use acid solutions, steel wool or other harsh abrasives.

c. If stains remain after washing, remove finish and restore in accordance to NAAM/NOMMA Metal Finishing Manual.
d. Repair or repair defective or damaged finish of components as directed by the architect.

D Measurement

The department will measure Architectural Glass Railing as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.13	Architectural Glass Railing	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

38. Aluminum Downspouts, Section 05 72 00, Item SPV.0105.14.

A Description

A.1 General

This special provision describes the fabrication, furnishing and installation of custom fabricated aluminum downspouts and aluminum sheet strap connectors shown on the architectural drawings, inferable there from and specified herein.

A.2 Submittals

a. Product Data, Shop Drawings and manufacturer's sample of the factory-applied finish.
    i. Indicate materials, finishes, dimensions, joining methods and relationship to adjacent work.
b. Submit manufacturer’s installation instructions

A.3 Delivery, Storage and Handling

a. Deliver materials in protective packaging to avoid damage to the material and finished surfaces.
b. Store material properly to avoid damage from abrasion, moisture and construction activity. Avoid excessive handling of material at the job site.

B Materials

a. Aluminum 3.5 inches O.D. pipe and /or tube, ASTM B 221 Alloy 6063-T5/T52 in a Fluoropolymer Coating, 70% PVDF finish.
b. Aluminum Pipe Flange Castings: ASTM B 26 Alloy A356-T6 finished to match pipe and/or tube.
c. Aluminum sheet (equivalent to 18 ga) 3105-H14 0r 3004-H34 alloy as per ASTM 3209-66 wrap-around tube attachment straps, pre-finished to match pipe and castings.

d. Fasteners shall be Series 410 stainless steel.
e. Non-shrink, non-metallic grout: ASTM C 1107, recommended by the manufacturer for pipe joints in exterior applications.

C Construction

C.1 Fabrication

a. Field will verify dimensions prior to fabrication of down spout bends and leader.
b. Fabricate down spout system from aluminum pipe or round tube factory bends, elbows and flange fittings with flush welds, ground smooth in the diameter indicated on the drawings.
c. Employ smooth curves by bending the pipe/tubing or using welded radius elbows. Make hairline joints butt tight and flush.
d. Assemble downspout systems in shop to the greatest extent possible with connections that maintain the structural value of the joined pieces.
e. Fabricate the attachment wrap-around straps from pre-painted aluminum sheet to anchor pipe/tube to steel columns. Use manufacturer standard flange fittings to fasten down spout to underside of built-in gutters.
f. Finish: Two-coat, baked-on full strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2) applied by manufacturer's approved applicator. Coating system shall provide a nominal 1.0 mil dry mil thickness, consisting of primer and a "White" color coat to be selected by the engineer.

C.2 Installation

a. Set down spout bends and leaders accurately in location, alignment, elevation and free from rack.
b. Fit exposed connections accurately together to form tight, waterproof, hairline joints.
c. Coat concealed surfaces of aluminum that will be in contact with cementitious materials or dissimilar metals, with a heavy coat of bituminous paint.
d. Anchor aluminum leader at the platform level in cast iron storm pipe bells filling the annular space with a hard rubber compression gasket and sealing the joint flush with the floor slab surface with a three part polyurethane, self-leveling sealant, ASTM C920, subject and resistant to salt water exposure in color to match natural concrete on platforms.

D Measurement

The department will measure Aluminum Downspouts as a single lump sum unit of work for aluminum downspouts, 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.0105.14	Aluminum Downspouts	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

39. Building Insulation, Section 07 21 00, Item SPV.0105.15.

A Description

A.1 General

This special provision described the furnishing and installation of all rigid plastic insulation and all mineral wool insulation and related accessories shown on the drawings, inferable there from and/or specified herein.

a. The work specified under this section includes:
   i. The mineral fiber blanket insulation around the Elevator Machine Rooms.
   ii. The rigid polystyrene board isolating the existing post office north wall and the new cast-in place concrete south knee wall.

A.2 Insulation Standards:

A.2.1 Thermal Conductivity:

The thickness shown on the drawings are for the thermal "k value" at 75 degrees F. for each type of insulation wherein k = Btu/hr/sq.ft./degree F/ in.

A.2.3 Surface-Burning Characteristics:

Comply with ASTM E 84, and as follows

a. Flame-Spread Index: 25 or less where exposed; otherwise, as indicated in Part 2 "Insulation Products" Article.
b. Smoked-Developed Index: 450 or less.

A.3 Environmental Conditions

a. Fire Hazard: Do not deliver plastic insulation membrane to the project site prior to the time of its installation. Protect material during delivery, handling and installation from exposure to fire. As soon as practical, complete the encasement of plastic insulation behind other work to minimize air supply and the possibility of flame spread.
b. Do not allow mineral blanket insulation and plastic insulation to become wet or soiled, or covered with ice or snow. Protect from exposure to high ambient temperatures or any manner of deterioration.

A.4 Submittals

a. Submit for information, manufacturer's data and installation instructions for each type of insulation required.

A.5 Related Work Specified Elsewhere

a. Section 03 30 00 – Cast-in-Place Concrete
b. Section 05 40 00 – Cold Formed Metal Framing
c. Section 07 41 00 – Composite Metal Panels
d. Section 09 21 00 – Gypsum Board Assemblies

B Materials

B.1 Insulation Materials

a. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, with flame-spread index of 25 or less Minimum "R" value of 5.0 per inch.
b. Mineral-Fiber-Blanket Insulation with vapor barrier membrane: ASTM C 665, Type III, Class A, with fibers manufactured from, slag wool, or rock wool, with recycled content so post-consumer recycled content plus one half of pre-consumer recycled content is not less than 50% and flame-spread index of 25 or less

B.2 Insulation Fasteners

a. Blanket Insulation: Galvanized, corrosion resistant anchors attached to cold rolled steel stud framing 16" o.c. by this sub-contract.
b. Rigid Insulation between concrete walls, as required to isolate the concrete pour

C Construction

C.1 Mineral Fiber Blankets Wall Installation

a. Install blanket insulation between metal stud walls and ceiling joists over the entire area to be covered, in the thickness indicated and specified to achieve the required R-values, securing the bats within the wall cavity with corrosion resistant anchors.
b. Cut and fit insulation blanket tightly around all obstructions so that no voids are left in the insulation layer. Ensure that any penetrations through the insulation are sealed, free from holes, tears and punctures.

C.2 Polystyrene Board Wall Installation

a. Install board insulation over areas that will be covered by the new cast-in-place concrete knee wall in thickness indicated on the drawings fastened as necessary to isolate the new construction from the existing.
b. Apply a bead of sealant to the inner edges of boards as they are being installed to minimize leakage of the concrete matrix.

D Measurement

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

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.15	Building Insulation	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

40. Composite Metal Panels, Section 07 41 00, Item SPV.0105.16.

A Description

A.1 General

This special provision describes furnishing all material, labor, services and equipment necessary for the fabrication, delivery and installation of composite coated aluminum and thermoplastic wall and ceiling panels, subgirts and fastenbers as shown on the architectural drawings, inferable there from and specified herein.

A.2 Composite Metal Panels

The composite metal panel includes the cladding of:

a. Walls, stringers and soffits on the stairs connecting the platforms and the mezzanine.
b. Walls, stringers and soffits on the escalators connecting the platforms and the mezzanine.
c. The mezzanine spandrels and ceiling over the platforms.
d. The exterior enclosure of the elevator shafts connecting the platforms and the mezzanine.
e. The exterior enclosure of the elevator machine rooms on the platforms.

A.3 Related Work Specified Elsewhere:

a. Section 03 30 00 Cast-in Place Concrete
b. Section 05 12 00 Structural Steel Framing
c. Section 05 50 00 Metal Fabrications
d. Section 07 92 00 Joint Sealants
e. Section 09 21 00 Gypsum Board Assemblies
f. Section 14 20 40 Holeless Hydraulic Elevators
g. Section 14 30 00 Heavy Duty Escalators

A.4. References

Standards listed by reference form a part of this specification section to the extent indicated.:

a. ASTM C297 Standard Test Method for Tensile Strength on Flat Sandwich Constructions in Flatwise Plane.
b. ASTM D1781 Standard Test Method for Climbing Drum Peel for Adhesives.
c. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
d. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors By Uniform Static Air Pressure Difference.
e. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors By Uniform Static Air Pressure Difference.
f. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
g. Underwriters Laboratories Inc. UL 94 Standard for Flammability of Plastic Materials for Parts in Devices and Appliances

A.5 System Description

a. Performance Requirements: Provide composite metal panels which have been manufactured, fabricated and installed to withstand loads from deflection and thermal movement and to maintain performance criteria stated by manufacturer without defects, damage or failure.
b. Deflection and Thermal Movement: Provide systems that have been tested in accordance to ASTM E330 and certified to conform to the following criteria under wind loading of 10 psf inward and 10 psf outward:
c. Normal Deflection: Deflection of perimeter framing member not to exceed L/175 normal to plane of the wall; deflection of individual panels not to exceed L/60.
d. Anchor Deflection: At connection points of framing members to anchors, anchor deflection in any direction not to exceed 1/16 inch (1.6 mm).
e. Thermal Movements: Allow for free horizontal and vertical thermal movement, due to expansion and contraction of components over a temperature range from -40°F to 120°F.
f. Buckling, opening of joints, undue stress on fasteners, failure of sealants, for any other detrimental effects of thermal movement will not be permitted.
g. Fabrication, assembly and erection procedures shall take into account the ambient temperature range at the time of the respective operation.
h. Water Leakage: Wall design shall feature provisions to drain to the exterior face of the wall any leakage of water at joints and any condensation that may occur within the construction.

A.6 Submittals

a. Product Data: Submit product data, including manufacturer's SPEC-DATA® product sheet, for specified products.
b. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures.
c. Include details showing thickness and dimensions of the various system parts, fastening and anchoring methods, locations of joints and gaskets and location and configuration of joints necessary to accommodate thermal movement.
d. Samples: Submit selection and verification samples for finishes, colors and textures for a factory applied custom primary color to be selected by the architect
e. Verification Samples: 12 inch × 12 inch sample composite panels in thickness specified, from an available stock color, including clips, anchors, supports, fasteners, closures and other panel accessories, for assembly approval. Include panel assembly samples not less than 24 inches × 24 inches (610 × 610 mm), showing 4-way joint.
    i. Include separate sets of draw down samples on aluminum substrate, not less than 3 inches × 5 inches of color and finish selected, for color approval .
f. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
g. Closeout Submittals: Warranty documents specified herein

A.7 Quality Assurance:

a. Installer Qualifications: Installer experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.
b. Manufacturer Qualifications: Company with a minimum of 5 years of continuous experience manufacturing panel material of the type specified.
c. Fabricator Qualifications: Company with at least 3 years of experience on similar sized metal panel projects and qualified by the panel material manufacturer. Capable of providing field service representation during construction.
d. Mock-Ups: Install at project site a job mock-up using acceptable products and approved installation methods. Obtain architect's acceptance of finish color (draw down samples to be used for color approval of nonstandard coil coated colors), texture and pattern and workmanship standard.
    i. Maintain mock–up during construction for workmanship comparison; if not incorporated into the final construction remove and legally dispose when no longer required.

A.8 Pre-installation Meeting

a. Conduct pre-installation meeting to verify project requirements, substrate conditions, installation instructions and warranty requirements.

A.9 Delivery and Handling

a. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Protect finish of panels by applying heavy duty removable plastic film during production.
b. Package composite wall panels for protection against transportation damage. Provide markings to identify components consistently with drawings.
c. Handling: Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

A.10. Storage and Protection

Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

a. Storage: Store panels in a well-ventilated space out of direct sunlight.
b. Protect panels from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
c. Slope panels to ensure positive drainage of any accumulated water.
d. Do not store panels in any enclosed space where ambient temperature can exceed 120 degrees F
e. Damage: Avoid contact with any other materials that might cause staining, denting or other surface damage.

A.11 Project Conditions

a. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

A.12 Warranty

a. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights owner may have under the Contract Documents.
b. Panel Integrity: 10 years commencing on Date of Substantial Completion.
   Finish: 20 years commencing on Date of Substantial Completion.
   Installation: Manufacturer 3 years
c. Qualifications: Composite coated aluminum and thermoplastic panels manufactured, Fabricated and installed to withstand thermal and wind load movements without buckling, opening of joints, undue stress, or any other detrimental effects.

B Materials

B.1 Composite Metal Panel Manufacturer

Basis of Design Product:

a. The design for Composite Metal Panels is based on "Alpolic" by Mitsubishi Plastics Composites America , Inc. Chesapeake, VA
b. 800 422 7270. Subject to compliance with the requirements, an equivalent product by one of the following manufacturers will be considered:
   "Alucobond" by 3A Composites USA Inc. Benton,. KY (800) 626-3365
   "North Clad ACM" by North Clad Rainscreen Solutions, Everett, WA (425) 740-3702

B.2 Composite Metal Panels Materials

a. Core: Thermoplastic material that meets performance characteristics specified when fabricated into composite assembly.
b. Face Sheets: Aluminum alloy 3105 H14, 0.020 inch (0.51 mm) thick and as follows: Coil coated with a fluoropolymer paint finish that meets or exceeds values expressed in AAMA 2605 where relevant to coil coatings.
   Thermally bonded in a continuous process, under tension, to the core material and obtained from a single source.
c. Bond Integrity: Tested for resistance to delamination as follows:
   i. Bond Strength (ASTM C297): 1500 psi (10.3 MPa) minimum.
   ii. Peel Strength (ASTM D1781): 22.5 in-lb/in (100 N-m/m) minimum.
   iii. No degradation in bond performance after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).

d. Fire Performance:
    i. Flamespread (ASTM E84): 25 maximum (6 mm).
    ii. Smoke Developed (ASTM E84): 450 maximum (6 mm).
    iii. Surface Flammability (Modified ASTM E108): Pass (6 mm).
    iv. V-O Rating Comply with UL 94.
e. Production Tolerances for panel thickness of 6 mm.
    i. Width: +/- 2 mm.
    ii. Length: +/- 4 mm.
    iii. Thickness (6 mm Panel): +/- 0.012 inch (0.3 mm).
    iv. Bow: Maximum 0.5% length or width.
    v. Squareness: Maximum 0.2 inch (5 mm).
    vi. Edges of sheets shall be square and trimmed.

B.3 Break Metal to match Composite Panels

a. .032 inch, 20 gauge 3104 - H 14 aluminum

B.4 Accessories

a. Provide fabricator's standard accessories, including fasteners, clips, anchorage devices and attachments.

B5.Finish

a. Factory applied fluoropolymer resin coating that meets or exceed values expressed in AAMA 2605 for coil coating in a custom primary blue hue to be selected by the architect.

C Construction

C.1 Fabrication

a. Shop fabricate to sizes and joint configurations indicated on the drawings.
b. Where final dimensions cannot be established by field measurements, provide allowance for field adjustment as recommended by the fabricator.
c. Form panel lines, breaks and angles to be sharp and true, with surfaces that are free from warp or buckle.
d. Fabricate with sharply cut edges, with no displacement of aluminum sheet or protrusion of core.

C.2 Examination

a. Verify that substrate conditions are acceptable for product installation.
b. Protect adjacent work areas and finish surfaces from damage during product installation.

C.3 Installation

a. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions.
b. Install panels plumb, level and true, with concealed fasteners in compliance with fabricator's recommendation.

c. Install the panels on the north side of the single escalators connecting Platforms 2 and 3 to the Mezzanine with the capacity to disassemble the installation, salvage the panels, and re-install the panels over the north side of an adjacent new second escalator on Platforms 2 and 3.
d. Anchor panels securely in place, in accordance to fabricator's approved shop drawings.
e. Comply with fabricator's instructions for installation of concealed fasteners and with provisions of Section 07 92 00 for installation of joint sealers.
f. Installation Tolerances: Maximum deviation from horizontal and vertical alignment of installed panels: 0.25 inch (6.4 mm) in 20 feet non-cumulative.

C.4 Field Quality Requirements

a. Provide fabricator's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance to fabricator's instructions.

C.5 Adjusting

a. Repair panels with minor damage such that repairs are not discernible distance of 10 feet
b. Remove and replace panels damaged beyond repair.
c. Remove protective film immediately after installation of joint sealers and immediately prior to completion of composite metal panel work.
d. Remove from project site damaged panels, protective film and other debris attributable to work of this section.

C.6 Cleaning

a. Remove temporary coverings and protection of adjacent work areas.
b. Clean installed products in accordance to manufacturer's instructions prior to owner's acceptance.
c. Remove construction debris from project site and legally dispose of debris.

C.7 Protection

a. Protect installed product's finish surfaces from damage during construction.
b. Institute protective measures as required to ensure that installed panels will not be damaged by work of other trades.

D. Measurement

The department will measure Composite Metal Panels as a single lump sum unit of work, acceptably completed.

E. Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.16	Composite Metal Panels	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

41. Corrugated Metal Panels, Section 07 46 00, Item SPV.0105.17.

A Description

A.1 General

This special provision describes the furnishing of all material, labor services and equipment necessary for the installation all exterior metal wall panels, and associated trim, all wall copings, flashing, sub-girts, sealants, and fasteners necessary to form the exterior and interior metal southwall panel system shown on the contract drawings and/or specified herein.

A.2 Corrugated Metal Panel Work

The corrugated metal panel work includes the cladding of the exterior south wall where it projects above and below the adjacent existing building (currently occupied by the U.S. Post Office) segments of varying heights and the cladding of the entire interior south wall between the concrete knee wall and the aluminum louver under the roof deck.

A.3 Related Sections Specified Elsewhere

a. Section 05 40 00 Cold-Formed Metal Framing
b. Section 05 50 00 Metal Fabrications
c. Section 07 92 00 Joint Sealants
d. Section 09 21 00 Gypsum Board Assemblies

A.4 References

a. American Society for Testing and Materials (ASTM):
    i. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
    ii. ASTM B 209 Standard Specification for Aluminum Alloy Sheet and Plate
b. American Iron and Steel Institute (AISI):
    i. Specification for the Design of Cold-Formed Steel Structural Members
c. American Institute of Steel Construction (AISC):
    i. Code of Standard Practice
d. American National Standards Institute (ANSI)

A.5 System Description

A.5.1 Exterior Rain Screen – South Wall

a. Single-skin exposed fastener corrugated galvanized and epoxy coated steel wall panel rain screen applied directly over sheathing as the exterior component of a non-insulated wall system, by others that includes an air and water resistant, corrugated vertical water coursing barrier that will provide the air and water infiltration performance on the outboard side of the wall.

A.5.2 Interior Finish – South Wall

a. Single- skin exposed fastener, corrugated galvanized and epoxy coated steel wall panel closure applied directly to cold rolled steel stud framing as the interior finish of a non-insulated wall by others. The interior wall panels shall be installed with the capacity of removal, salvage and re-installation to enable the addition of vertical and horizontal electrical conduit runs at a future date.

A.5.3 Corrugated Wall Panel System

a. The installation of panel ribs running horizontally, will be provided with end closures by the metal wall panel manufacturer/subcontractor.
b. The wall panel system is mitered at the building corners, trimmed at openings and ends with cold rolled sections and capped at the parapet with a coping of the same material and finish as the wall panels.
c. Wall panel system shall be manufactured and installed to withstand specified design loads and maintain performance requirements without defects, damage, or failure.
b. Design wind loads shall be as specified below, acting normal to the plane of the wall, or as indicated on the contract drawings.
    i. Main Wall: 25 psf.
    ii. Corners: 30 psf
    iii. Corner zones shall be defined as 10 feet from building outside corners.
    iv. Wall panels shall be designed for a maximum deflection under loading of L/120.
    v. Provide for the expansion and contraction of system components due to ambient temperature and solar heat gain. Accommodate movement due to temperature change without buckling, undue stress on structural elements, reduction of performance or other damaging effects. Anticipate a temperature range of minus 40 to plus 120 degrees F.

A.6 Submittals

a. Submit product data, test reports, and certifications in accordance to quality assurance and performance requirements specified herein.
b. Submit panel shop drawings consisting of design and erection drawings, finish specifications, and other data necessary to clearly describe the design, materials, sizes, layouts, construction details, and erection. Submit small-scale layouts of panels and large-scale details of edge conditions, joints, fastener and sealant placement, flashings, penetrations, and special details. Distinction must be made between factory and field assembled work.
    i. Drawings must be approved prior to fabrication.
c. Submit relevant structural design calculations, in accordance to the AISI Specification for the metal wall panel system.
    i. A professional engineer registered in the State of Wisconsin shall certify the calculations.
d. Samples:
    ii. Panel for each type: Full panel width by 12 inches long in the specified and selected finish.

iii. Fasteners: Two of each type with statement of intended use and specified finish
iv. Closure: One metal closure and one foam closure as required.
v. Sealants: One sample of each type with statement of intended use.

A.7 Quality Assurance

a. Manufacturers Qualifications: The manufacturer shall have had a minimum of ten years' experience in the successful completion of projects employing similar materials, applications, and performance requirements.
    i. Manufacturer shall provide a list of five similar completed projects with addresses of the project location, architect, and owner.
b. Installers Qualifications: The wall systems contractor shall have had a minimum of ten years experience in the successful completion of projects employing similar materials, applications, and performance requirements.
    i. The wall systems contractor shall provide a list of five similar completed projects with addresses of the project location, architect, and owner.
c. Single Source Responsibility: Furnish basic materials, panels, trim, accessories, fasteners from a single source manufacturer or from a manufacturer approved by the basic materials supplier.

A.8 Delivery, Storage and Handling

a. Materials shall be unloaded and stored per the manufacturer's instructions to prevent damage due to handling and weather.

A.9 Warranties

a. Material Warranty: The manufacturer shall warrant that the materials and accessories furnished in accordance to these specifications shall remain free from defects in material and factory workmanship for a period of one year from date of substantial completion.
b. Finish Warranty: The manufacturer shall warrant against fading, chalking, peeling, cracking, checking, chipping of the exterior coated finish, or erosion to base metal due to corrosion, for a period not less than 20 years from date of shipment.

B Materials

B.1 Manufacturers

a. CENTRIA, Moon Township, PA 800 759 7474
b. CROWN CORR , Gary, IN 219 949 8080
c. STEELITE , Pittsburg, PA 800 824 1371
    i. Proprietary Names: Use of manufacturer's proprietary product names to designate materials, is not intended to imply that products named are required to be used to the exclusion of products by other manufacturers.

B.2 Metal Panels

a. Metal Panel profile shall have 34 2/3" coverage width and a 3/4" deep symmetrical corrugations spaced 2.67" o.c.

b. Metal panels shall be fabricated from zinc coated steel conforming to ASTM A 924 and ASTM 653 SQ Grade 37, G 90 coating with the following three finish on one (1) side:
    i. 0.2 mil nominal Epoxy Primer.
    ii. 2.7 mil nominal Epoxy Barrier Coat in a (white) color selected by the architect.
    iii. 1.5 mil nominal Urethane Coat in a (white) color selected by the architect.
c. Material shall be a minimum 22 gauge (20 gage when required by wind loads) with a smooth surface texture to receive an epoxy coil coated finish; maximum metallic waviness of 0.74 microns and a maximum spangle facet size of 300 microns per ASTM E 112.
d. All concealed exterior flashing and concealed closures shall be fabricated in the same smooth material, gage, zinc coated, as the exterior profile, unless otherwise noted.
e. All visible panel end closures, trim, wall copings, shall be fabricated from zinc coated 18 gauge smooth sheet metal with a zinc and coil coated epoxy finish to match the adjacent ribbed panels.
f. Horizontal exterior profile panel inside and outside corner assemblies shall be trimless, mitered, notch bent and structurally bonded by the panel manufacturer and match the finish and appearance of the adjacent panel. Welded corners or mitered corner assemblies with exposed rivets or fasteners are unacceptable.
g. Coping and panel edges shall be trimmed with bent edge assemblies fabricated from 18 gauge coiled coated sheet metal to match the adjacent ribbed panels.

B.3. Accessories

a. Wall panel system accessories and fasteners: matching metal panels in finish and material required for a complete system, including clips, closure strips and trim.
b. Fasteners shall be 300 series stainless steel with 5/8" bonded neoprene and stainless steel washers coated to match the exterior panel color.
c. Closures shall be metal and/or foam as required, with foam pre-cut profiles of closed cell foam and metal closures fabricated from the same material, gage as the metal panels.
d. Rivets shall be non-corrosive metal compatible and match in color with the metals being fastened.

B.4 Sealants

a. Hidden sealant at all side laps, end laps, and flashing details shall be gun grade non-curing butyl or polymeric non-skinning butyl tape to ensure weather tightness.
b. Exposed sealant shall be two-part gun grade polyurethane modified sealant (2 PUMS) as specified in Section 07 92 00. Class A Type II non-sag elastomeric with the capability to withstand 25 percent movement in both extensions and compression in color to match the metal panels.

C Construction

C.1 Fabrication

Wall panel system components shall be fabricated in the factory for field assembly to the greatest extent possible with the following production tolerances

C.2 Inspection

a. Wall panel systems contractor shall check the alignment of the structural supports. Alignment exceeding tolerances defined in the AISC Code of Standard Practice shall be corrected prior to proceeding with the installation of the wall panel system.
b. Wall panel systems contractor shall inspect installation of vapor permeable air and water barrier for compliance with manufacturer's installation instructions. Corrections necessary to ensure specified performance shall be made prior to wall panel installation.
c. Coordinate the installation of metal panels with the other adjacent elements of the building envelop.

C.3 Installation

a. Manufacturer shall provide detailed instructions covering the tools, fasteners, sealants, and assembly procedures required to achieve the structural, and weathering performance specified.
b. Metal filings caused by cutting and drilling shall be immediately removed from finished surfaces to prevent rusting and staining.
c. The wall panel systems contractor shall coordinate work with other trades as required to ensure proper flashing and seals with adjoining construction.

C.4 Damaged Material and Cleaning

a. Damage caused by the manufacturer or wall panel systems contractor shall be repaired or replaced.
b. The general contractor shall inspect and approve each completed wall area and be responsible for protecting finished work from damage by other trades.
c. The wall panel systems contractor shall remove all protective materials and labels from the wall components as they are installed.
d. The general contractor shall be responsible for final cleaning of the wall panel system due to any conditions that occur after the wall panel systems contractor has completed an area. Cleaning is to be done in accordance to the manufacturer's instructions and prior to final acceptance.

D Measurement

The department will measure Corrugated Metal Panels as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.17	Corrugated Metal Panels	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

42. EPDM Membrane Roofing, Section 07 53 00, Item SPV.0105.18.

A Description

A.1 General

This special provision describes the furnishing of all labor materials, services, equipment and supervision for the complete supply and installation of a single ply EDPM white-on-black fleeceback fully adhered membrane roofing and flashing system in conjunction with a low-rise foam adhesive and a fiberglass reinforced gypsum roofing substrate board over a new steel roof deck as shown on the architectural drawings, inferable there from and specified herein.

A.2 Membrane Roofing

Membrane roofing system includes:

a. Substrate protection board
b. Adhesives and fasteners
c. Roof Membrane
d. Seam tape
e. Seam cover
f. Base flashing
g. Roof protection flashing
h. Metal counter flashing
i. Mechanical and Electrical penetration flashing sleeves
j. Protective walkway surfacing

A.3 Qualifications

a. The manufacturer is FM Approved for a membrane roofing system to the one specified herein.
b. The system is listed on the DOE's "Energy Star Roof Products "
c. Qualified Products List for low slope energy performing roof products.
d. The installation contractor shall have been trained and be franchised by the roofing system manufacturer.
e. The installation contractor shall be fully knowledgeable of all requirements of the contract documents and all job site conditions that will affect the work.
f. The exterior fire test exposure: ASTM E 108 and/or UL Class A

A.4 Warranty

a. Provide manufacturer's 30 year total system warranty covering both labor and material with no dollar limitation. The maximum warranty wind speed shall be 3-second peak gusts of 80 mph measured at 30'-0" above ground level. Certification is required indicating the manufacturer has reviewed and agreed to this coverage.

b. Warranty shall also cover leaks caused by accidental punctures (up to 16 man-hours per year) and leaks caused by 2” diameter hail
c. Pro-rated system warranties shall not be accepted.
d. Evidence of the manufacturer’s warranty reserve shall be included as part of the project submittals for review by the architect.

A.5 Submittals

a. Shop drawings showing layout, details of construction and identification of materials.
b. A sample of the manufacturer's total system warranty.
c. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.
d. Certification of the manufacturer's warranty reserve.
e. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the architect prior to the issuance of the manufacturer's warranty.

A.6 Product Delivery, Storage and Handling

a. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.
b. Comply with the manufacturer's written instructions for proper material storage.
    i. Store membrane in a dry area. Moisture absorbed by the fleece backing must be removed using a wet-vac system prior to membrane adhesive.
    ii. Store other materials between 60°F and 80°F in dry areas protect from water and direct sunlight. If exposed to lower temperature, restore to 60°F minimum temperature before using.
    iii. Store materials containing solvents in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.
c. Insulation must be on pallets, off the ground and tightly covered with waterproof materials.
d. Any materials which are found to be damaged shall be removed and replaced at the contractor's expense.

A.7 Work Sequence

a. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.
b. Do not disrupt activities in occupied spaces.

A.8 Use of the Premises

a. Before beginning work, the roofing contractor must secure approval from the building owner's representative for the following:
    i. Access to the site.
    ii. Areas permitted for storage of materials and debris.
    iii. Areas permitted for the location of cranes, hoists and chutes for loading and unloading materials to and from the roof.
b. Stairs or elevators may not be used for removing debris or delivering materials.

A.9 Preconstruction Conference

a. A preconstruction meeting will be held at the job site to verify the actual conditions and dimensions of the roof.
b. Any conditions which are not shown on the contract drawings should be indicated on the shop drawings.

A.10 Temporary Facilities and Controls

A.10.1 Temporary Utilities

a. Water, power for construction purposes and lighting at the site and will be made available to the roofing contractor by the general contractor.
b. Provide all hoses, valves and connections for water from a source designated by the general contractor.
c. Electrical power should be extended as required from the source. Provide all trailers.
d. The roofing contractor shall be responsible for the provision and maintenance of portable toilets or their equal.

A.10.2 Building Site

a. The roofing contractor shall use reasonable care and responsibility to protect the building and site against damages. The contractor shall be responsible for the correction of any damage incurred as a result of the performance of the contract.
b. The roofing contractor shall remove all debris from the job site in a timely and legally acceptable manner so as to not detract from the aesthetics or the functions of the building.

A.11 Job Site Protection

a. The roofing contractor shall adequately protect building, paved areas, service drives, etc. from damage while performing the required work. Provide canvas, boards and sheet metal (properly secured) as necessary for protection and remove protection material at completion. The contractor shall repair or be responsible for costs to repair all property damaged during the roofing application.
b. During the roofing contractor's performance of the work, the building owner will continue to occupy the existing building. The contractor shall take precautions to prevent the spread of dust and debris, particularly where such material may sift into occupied areas. The roofing contractor shall provide labor and materials to construct, maintain and remove necessary, temporary enclosures to prevent dust

or debris in the construction area(s) from entering the occupied areas of the building.

c. Do not overload any portion of the building, by either use of or placement of equipment, storage of debris, or storage of materials.
d. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.
e. Take precautions to prevent gutter drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required. At completion, test drains to ensure the system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or other telltales on plugs. Remove plugs each night and screen drains.
f. Store moisture susceptible materials above ground and protect with waterproof coverings.
g. Remove all traces of piled bulk material and return the job site to its original condition upon completion of the work.

A.12 Safety

a. The roofing contractor shall be responsible for all means and methods as they relate to safety and shall comply with maintain a safe environment for the facility's occupants including staff, visitors, customers and the occurrence of the general public on or near the site.

A.13 Workmanship

a. Applicators installing new roof, flashing and related work shall be factory trained and approved by the manufacturer they are representing.
b. All work shall be of highest quality and in strict accordance with the manufacturer's published specifications.
c. There shall be a supervisor on the job site at all times while work is in progress.

A.14 Quality Assurance

a. The fleeceback adhered roofing system must achieve an ASTM E 108 and/or UL Class A rating.
b. The manufacturer must have a minimum of 20 years experience in the manufacturing of vulcanized thermal set sheeting.
c. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.
d. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least 5 years' successful experience installing single-ply EPDM roofing systems and having installed at least one roofing application or several similar systems of equal or greater size within one year.

e. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and an experienced superintendent on the job at all times roofing work is in progress.
f. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the architect. Any deviation from the manufacturer's installation procedures must be supported by written certification on manufacturer's letterhead and presented for the architect's consideration.
g. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the architect 72 hours prior to the manufacturer's final inspection.

B Materials

B.1 General

a. Unless otherwise approved by the architect and accepted by the membrane manufacturer, all products (including membrane, substrate boards, low-rise foam adhesives, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty.
b.

B.2 Manufacturer

a. Basis of Design Product: The design for the fully adhered EDPM fleeceback roofing is based on Carlisle SynTec Systems, Carlisle, PA. Subject to compliance with the specified and detailed requirements a comparable product will be considered as manufactured by:
    i. Firestone Building Products Co, Carmel IN
    ii. GenCorp Polymer Division , Maumee, OH
    iii. Johns-Manville, Denver, CO

B.3 Membrane

a. Furnish white-on-black EPDM fleeceback membrane. Membrane shall be 90 mil EPDM thickness factory-laminated to 55 mil external fleece backing. The membrane shall conform to the minimum physical properties of ASTM D4637-96, Type III (fabric-backed membrane). Membrane sheets shall incorporate factory-applied splice tape along the length of the membrane. Membrane shall have Solar Reflectance Index (SRI) of minimum 105 per ASTM D1980.

B.4 Substrate Board

a. Substrate shall be secured to metal roof deck with low-rise foam adhesive, to provide a totally non-penetrating roofing system.
b. Substrate shall be ½" fiberglass reinforced exterior grade gypsum board.

B.5 Adhesives and Cleaners

All products shall be furnished by roofing materials manufacturer and specifically formulated for the intended purpose.

a. Foam adhesive: low-rise foam adhesive with negligible VOC content
b. Splice tape and primer
c. Splicing cement
d. Cleaning solvents: splice cleaner or membrane cleaner
e. External seam sealant: lap sealant
f. Sealer: pourable sealer

B.6 Fasteners and Plates

To be used for mechanical attachment of substrate board, where required:

a. Fasteners: A threaded, black epoxy electro-deposition coated fastener used with steel roof decks.
b. Term Bar (When required) A 1-1/4" long expansion anchor with a zinc plated steel fasteners applicable for fastening termination bars to steel plate curbs.
c. Insulation Fastening Plates: a nominal 3 inch diameter metal plate used for insulation attachment in conjunction with approved fasteners.

B.7 Metal Edging and Membrane Terminations

a. All edge metal must be provided by and warranted by roofing materials manufacturer.

B.8 Walkways

a. Protective surfacing for roof traffic shall be 24"x24" molded white rubber with factory rounded corners to be secured to the roof membrane with SecurTape/HP-250 primer.

B.9 Other Materials

a. Metal Counter Flashing: 26 gage Zinc/Tin Alloy Coated and pre-weathered Type 304 Stainless Steel (TCS II) ASTM 240/A 240 M, dead soft annealed sheet coated on both sides. (See Section 07 61 00 Sheet Metal Gutters and Flashing).
b. Fasteners: Minimum 7/8 Series 300 stainless steel ring shank or equal screw type.
c. Solder and Flux: Pure tin solder with rosin, removing pre-weather wash with lacquer thinner and neutralizing flux residue with soda water.

C Construction

C.1 Job Conditions, Cautions and Warnings

a. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.
b. Do not apply low-rise foam adhesive when surface and/or ambient temperatures are below 40°F. When using low-rise foam adhesive in heated spray equipment, the adhesive cannot be applied unless surface and/or ambient temperatures are 25°F or warmer. When using low-rise foam adhesive in non-heated spray equipment, surface and/or ambient temperatures must be 60°F or warmer.

c. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.
d. When loading materials onto the roof, the applicator must comply with the requirements of the building structure to prevent overloading and possible disturbance to the building structure.
e. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance to the manufacturer's requirements and recommendations.
f. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
g. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.
h. The surface on which the roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
i. New roofing shall be complete and weather tight at the end of the work day.
j. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.
k. Comply with the manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, job site considerations and weather restrictions.

Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.

C.2 Substrate Placement

Secure substrate to metal deck with low-rise foam adhesive.

C.3 Membrane Placement and Bonding

a. Position and unroll successive sheets and align to provide for a minimum 3 inch wide splice.
b. Fold adjacent sheets in half lengthwise to exposed substrate area.
c. **Note:** Fold selvage sheet edges (along the length of the sheets) under the membrane to prevent overspray onto the splice area.
d. Apply low-rise foam adhesive onto the substrate and allow to foam up approximately 1/8 inch.
e. Place the membrane into adhesive and roll the membrane with a weighted rubber coated roller to set the membrane into the adhesive.
f. Apply low-rise foam adhesive to the substrate and continue process described above until all sheets are fully bonded.

C.4 Membrane Splicing

a. General:
   The fleeceback membrane must have selvage edges (the fleece-backing is discontinued) and pre-applied splice tape along the length of the sheet for membrane splicing. Selvage edges are not provided along the width of the membrane; adjoining membrane sheets are butted together and overlaid with a cover strip.
b. Membrane Splicing with Splice Tape
   i. Overlap adjacent sheets for the proper splice width.
   ii. Fold the top sheet back and clean the dry splice area with primer as required by the membrane manufacturer.
   iii. Where splice tape is not pre-applied (end laps, flashing details, etc.), apply splice tape to bottom sheet with the edge of the release film along a pre-marked line (approximately 1/2" out from the top sheet edge). Press tape onto the sheet using hand pressure. Overlap tape roll ends a minimum of 1 inch.
   iv. Remove the release film and press the top sheet onto the tape using hand pressure.
   v. Roll the seam toward the splice edge with a 2” wide steel roller.
   vi. Install flashing over all field splice intersections and seal edges of flashing with lap sealant.

C.5 Flashing

a. Wall and curb flashing shall be cured membrane. Continue the deck membrane as wall flashing where practicable.
a. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

C.6 Walkways

a. Install walkways at all traffic concentration points and as identified on the Contract drawings.
b. Adhere walkways to the membrane in accordance to the manufacturer's specifications.

C.7 Daily Seal

a. When the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
b. Use low-rise foam adhesive or other similar material in accordance to the manufacturer's requirements.

C.8 Clean Up

a. Perform daily cleanup to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.

b. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

D Measurement

The department will measure EPDM Membrane Roofing as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.18	EPDM Membrane Roofing	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

43. Sheet Metal Gutters and Flashing, Section 07 61 00, Item SPV.0105.19.

A Description

A.1 General

This special provision describes all labor, materials, services and equipment necessary for the complete supply and installation of sheet metal, gutters, flashing and trim which are shown on the drawings, inferable there from and / or specified herein.

The sheet metal work includes both painted aluminum and stainless steel:

a. Preformed sheet metal gutter liners, fascias, soffits and trim.
b. Connection hardware for attachments of sheet metal to other building components
c. Metal flashings related to EPDM roofing membrane
d. Sheet metal panel components, flashing and sealants between the shed envelope and any adjoining construction,
e. Metal cap flashings and wall copings
f. Mechanical and Electrical penetration flashing sleeves

A.2 Related work specified elsewhere:

a. Section 05 12 00 Structural Steel
b. Section 05 50 00 Metal Fabrications
c. Section 05 72 00 Aluminum Downspouts
d. Section 07 46 00 Metal Wall Panels
e. Section 07 53 00 EPDM Membrane
f. Section 08 41 00 Aluminum Window Wall
g. Section 10 20 00 Louvers and Vents

A.3 Related work that is not included:

a. Section 08 63 00 Metal Frame Skylights Flashings

A.4 Quality Assurance

a. Subcontract the sheet metal work to a single firm specializing in sheet metal work with a minimum of 5 years experience with work comparable to the work shown and specified. Installer must have been trained and certified by the sheet metal manufacturer in the application of the specified sheet metal products.
b. The sheet metal manufacturers must be capable of providing technical counsel services and field reviews to the subcontractor, as the work progresses.

A.5 Environmental Conditions

a. Do not proceed with sheet metal work during inclement weather (or when weather forecasts are unfavorable) or until all drains and penetrations have been installed and until the substrate is completely dry, cleaned of debris. The placing of any sheet metal shall constitute acceptance of the substrate by the Installer.
b. At the end of each workday and when weather threatens, provide water cut-offs that are proven effective in providing weather-tight seals and prevent moisture penetration.
c. When covering sheet metal is required, provide for free air flow around the sheet metal materials to the manufacturer's requirements to prevent "white rust"

A.6 Product Handling.

a. Materials shall be delivered, handled and stored by methods approved by the manufacturer. Ventilate under and tilt the sheet metal sufficiently to ensure no water remains on covering materials.
b. Comply with other precautions and recommendations by the manufacturer, including the wearing of clean gloves, to minimize the amount of final cleaning required.

A.7 Standards

a. SMACNA – Architectural Sheet Metal Manual; 5th. Edition, Chapter 6 as a minimum standard and these specifications where the SMACNA Standard is exceeded.
b. Sheet Metal Manufacturer Proprietary Specifications for the fabrication and installation procedures.

A.8 Submittals

a. Shop Drawings: Prior to fabrication, submit to the architect for review, sheet metal layouts, fastener layouts, and details of all terminations, joints and/or penetrations drawn at a scale of not less than 3" = 1'-0". The shop drawings shall be reviewed by the sheet metal manufacturer prior to submittal to the architect
b. Submit finish material samples, at least 4 inches square.
c. Guarantee: The roofing subcontractor will provide a three year guarantee signed by the contractor and sheet metal roofing subcontractor, agreeing to perform repair work required because of failure of materials, workmanship within the period of guarantee, without cost to the owner and repair work required for defects occurring three years beyond the guarantee for the itemized cost of labor and materials plus a total of 15% mark-up for overhead and profit.

A.9 Design Criteria

a. Sheet metal shall be designed and erected to provide a completely weather tight enclosure capable of enduring expansion and contraction of its component materials caused by ambient temperatures ranging from – 40 degrees F to +120 degrees F. without causing harmful buckling, failure of joint seals, undue stress on fasteners or any other detrimental effects.
b. Sheet metal shall withstand positive and negative pressure resulting from wind loading shown in the SMACNA Manual – 5th. Edition., without exceeding the maximum working stress for fasteners and members or allowable maximum deflections.
c. Sheet metal roofing panel fabricator shall field verify dimensions and the structures and design the system to accommodate erection tolerances.

A.10 Coordination

a. Coordinate gutter installation with Gutter Heat Tracing Cable specified under Section 26 86 00

B Materials

B.1 Concealed Sheet Metal

a. Concealed Gutter Liners:
    i. 22 gauge Zinc/Tin Alloy Coated and pre-weathered Type 304 Stainless Steel (Terne Coated Stainless Steel)) ASTM 240/A 240 M , dead soft, fully annealed sheet, coated on both sides.
b. Concealed Flashing and Counter Flashing:
    i. 26 gauge Zinc/Tin Alloy Coated and pre-weathered Type 304 Stainless Steel (Terne Coated Stainless Steel)) ASTM 240/A 240 M, dead soft, fully annealed sheet, coated on both sides.
c. Cleats:
    i. TCS Sheet Metal: Manufacturer's preformed cleats or fabricated from TCS flat stock sheet to manufacturer's specifications to meet load requirements.
d. Fasteners:
    i. Minimum 7/8" Series 300 stainless steel ring shank nail or equal screw type fastener.
e. Solder and Flux:
    i. TCS Sheet Metal Pure tin solder with rosin or Speed Flux, removing pre-weather wash coat with lacquer thinner and neutralizing flux residue with soda water.
f. Ventilating Mat / Slip Sheet:
    i. Woven Nylon Mat "Enkamat 7010" or sheet metal manufacturer accepted equivalent.

B.2 Visible Sheet Metal

a. Visible Counter Flashing and Copings:
    i. 0.063" minimum pre-painted /coiled coated 70% Kynar 500 fluorocarbon finish aluminum in a "white" color selected by the architect to match Window Wall and Louver finish. Visible flashing projections 0.032 aluminum.
    ii. Sheet metal thickness selected for the application to maintain flatness and avoid "oil canning".
b. Cleats:
    i. Mill finish aluminum flat stock sheet to manufacturer's specifications to meet load requirements.
c. Fasteners:
    i. Minimum 7/8" Series 300 stainless steel ring shank nail or equal screw type fastener.
    ii. Aluminum rivets
d. Ventilating Mat / Slip Sheet
    i. Woven Nylon Mat "Enkamat 7010" or sheet metal manufacturer accepted equivalent.

C Construction

C.1 Fabrication

a. Sheet metal gutters, flashings, counter flashings and copings shall be fabricated referenced standards and in compliance with reviewed shop drawings in a shop to the maximum extent
b. All cap counter flashings sections shall be formed square, true and accurate to the sizes and profiles detailed. All sections shall be free from distortion and other defects detrimental to appearance.
c. Use double lock standing seam and "S-Lock" fabricated from flat sheet stock with hook strip jointing and edges. Preform gutters as a "one-piece sloping segments" to have one end fixed and one end allowed to expand.
d. The sheet metal systems shall be designed to be watertight without the use of sealants, except for the isolated cases of special intersections.

C.2 Acceptable Conditions

a. Prior to the installation of the sheet metal, and at the contractor's direction meet at the project site to examine the areas and conditions under which work in this Section will be performed and to verify that the substrate is sound, dry, smooth, clean, completely anchored, and that all other items attaching or penetrating through the work have been installed.
b. Do not proceed with the roofing installation until unsatisfactory conditions have been corrected and are acceptable to the roofing subcontractor. Commencing work shall imply acceptance of Conditions.
c. Erection work shall be carried out by crews trained by the manufacturer, in accordance to the manufacturer's specifications and in strict accordance with the reviewed shop drawings.

d. Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment. Coat back side of sheet metal with bituminous coating where it will contact ferrous metal, or cementitious construction.

C.3 Installation

a. Install sheet metal only in dry weather.
b. Space fasteners as required to resist design uplift, but not more than 12".
c. Anchor sheet metal components with provisions for thermal and structural movement with concealed fasteners.

C.3 1 Application of Slip Sheet:

a. Before installing gutters and copings panels, install layer of ventilating mat, directly under the preformed gutter. Hold in place with non-corrosive staples, until it is securely held in place with the fixed and sliding panel cleats.

C.3.2 Soldered Joints:

a. Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except where pre-tinned surface would show in finished work.
    i. Do not use abrasives in preparing surfaces for soldering.
    ii. Do not use torches for soldering. Heat surfaces to receive solder with soldering irons and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

C.3.3 Erection of Visible Sheet Metal Panels

a. Install work with lines and corners of exposed units true and accurate and metal grain in the direction of seams. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of sealant. Fold back sheet metal to form a hem on concealed side of exposed edges.

C.3.4 Sealant Applications:

a. When required, sealant and joint backing shall be provided to intermediate and perimeter joints in sheet metal panels and at joints between the sheet metal and adjoining constructions.

C.4 Clean-Up and Acceptance

a. Remove and replace any dented or damaged materials.
b. Remove and properly dispose of all foreign material and debris from roof and gutters. Make certain that no metal or other materials are left on the roof.
c. Clean and neutralize all flux materials and clean all excess solder and sealants.
d. Wipe off all handprints, smudges and other superficial stains, that may have been left on the metal roofing during fabrication and installation. The finished work shall be free of oil, grease, dirt and any form of soiling.
e. Protect the finished metal work until final acceptance.

D Measurement
The department will measure Sheet Metal Gutters and Flashing as a single lump sum unit of work, acceptably completed.

E Payment
The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.19	Sheet Metal Gutters and Flashing	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

44. Joint Sealants, Section 07 92 00, Item SPV.0105.20.

A Description
A.1 General
This special provision described the furnishing of all labor materials, services and equipment for the complete supply and installation of joint sealants, joint fillers and related accessories shown on the architectural and selective demolition drawings, inferable there from and specified herein.

A.2 The joint sealant work includes:
a. Concrete wall joints
b. Aluminum window wall joints and where the window wall abuts other materials such as cast-in-place concrete and pre-cast concrete.
c. Aluminum cladding system joints and adjoining construction.
d. Corrugated metal panel system joints and adjoining construction.
e. Concrete floor to wall joints, saw cuts and control joints.

A.3 Related work specified elsewhere:
a. Concrete Structures
b. Section 07 41 00 Composite Metal Panels
c. Section 07 46 00 Corrugated Metal Panels
d. Section 08 12 00 Aluminum Doors and Frames
e. Section 08 41 00 Aluminum Window Wall
f. Section 08 63 00 Metal Framed Skylights
g. Section 09 61 40 Detectable Warning Tiles
h. Section 10 20 00 Louvers and Vents

A.4 Submittals
a. Product data and color samples
b. Guarantee: Submit to the architect for transmittal to the owner a written guarantee agreeing to repair or replace sealant compounds which fail to provide airtight or watertight joints, or fail in adhesion, cohesion abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or appear to

deteriorate in any other manner. The period of guarantee shall be three years and shall be signed by the manufacturer and installer.

A.5 Environmental Conditions

a. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F. Do not install sealants during inclement weather.
b. Whenever possible schedule the installation and the care of elastomeric sealants during periods of relatively low temperatures, so that tensile stresses upon the cured sealants will be minimized.

A.6 Quality Assurance

a. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this project.
b. Pre-construction Field Adhesion: Before installing elastomeric sealants, field test their adhesion to project joint substrates in accordance to ASTM C 1193.

A.7 Sample Application

a. Provide a sample application of sealants at locations designated by the architect. The samples shall present the primary type of materials, substrate surfaces, joint size, exposure. Preparation, priming and curing shall replicate the specification and be scheduled at least one week prior to starting the installation to allow for any necessary adjustments.
b. The sample shall be visually examined for color, general workmanship, and appearance. The sample shall also be cut and pulled, and examined for internal bubbles or voids, adhesion and general compatibility with the substrates.

B Materials

B. 1 Sealant for use in Cast-in-Place Concrete and Pre-cast Concrete walls

a. Two Part Polyurethane Modified Sealant (2 PUMS) Class A Type II non-sag elastomeric sealant with the additional capability to withstand 25 percent movement in both extension and compression for a total of 50 percent movement in color to match the substrate.
    i. Pecora Corporation: "Dynaflex".
    ii. Sonneborn/Chem Rex Inc.: "Sonolastic NP-2"
    iii. Tremco Mfg. Co: "Dymeric"
    iv. L.M. Scofield Co.: "Lithoseal Buildingcalk – 3G"

B.2 Sealant for use in Aluminum Window Wall joints, the Composite Metal Panel joints, the Corrugate Metal Panel joints and where these systems abuts other materials such as concrete, steel, gypsum board and metal flashing:

a. Two Part Polyurethane Modified Sealant (2 PUMS) Class A Type II non-sag elastomeric sealant with the additional capability to withstand 25 percent movement in both extension and compression for a total of 50 percent movement in color to match the substrate.

i. Pecora Corporation: “Dynaflex”.
ii. Sonneborn/Chem Rex Inc: “Sonolastic NP-2”
iii. Tremco Mfg. Co: “Dymeric”
iv. L.M. Scofield Co: “Lithoseal Buildingcalk – 3G”

B.3 Sealant for use in Concrete Floor to wall joints, floor saw cuts , control joints and stair landings detectable warning tile perimeters.

a. Three Part Polyurethane Sealants (3 PUS), self leveling and salt resistant for horizontal applications that are traffic bearing, in color to match natural concrete paving and stairs.
    i. Tremco Mafg. Co: “THC 900/901”
    ii. L.M. Scofield Co.: “Lithoseal Trafficalk 3G”
    iii. Sonneborn/ChemRex Inc.: “SL-2”

B.4 Joint Sealant Backing:

Non-staining, compatible with joint substrate, sealants, primers and approved for the application by the sealant manufacturer.

a. Cork joint filler (CJFRN) Resilient and non-extruding ASTM D 1752 , Type II
b. Expanded Polyethylene Joint Filler (EPEJF) ASTM C 1330, closed Cell, not less than 5.0 psi for 25% compression, compatible with the related sealant and resistant to petroleum, oils, salts, solvents and a surface water absorption of not more than 5%.
c. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by the sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint.

C Construction

C.1 Fabrication

a. Not Applicable

C.2 Preparation

a. Install concrete slab edge cork expansion joints prior to concrete pour.
b. Clean bonding joint surfaces to remove deleterious substances which might interfere with bond.
c. Concrete surfaces shall be etched with a 5 % solution of muriatic acid to remove excess alkalinity and rinsed thoroughly with a diluted ammonia solution and then with clear water and dried before installing backer rods and elastomeric sealants.

C.3 Installation

a. Comply with ASTM C 1193
b. Prime the bonding joint surfaces in accordance to the sealant manufacturer’s recommendations.
c. Install bond breaker backer rods as recommended by the sealant manufacturer.
d. Apply sealant in continuous beads, filling joint from the bottom without openings or air pockets, forming equal areas of side contact.

e. Confine compounds to joint using masking tape to prevent spillage to adjoining surfaces.
f. Apply elastomeric sealants to the following depths.
    i. In floor, sidewalks, to a depth of 75% of the joint width but not less than 3/8" and not more than ¾" or less than 1/16" below the adjoining surfaces.
    ii. In joints not subject to traffic, to a depth of 50% of the joint width, but not less than ¼" and not more than ½".
g. Tool filled joint so as to compress compounds slightly concave and provide a slight wash where vertical and horizontal joints meet.
h. Remove excess compound or sealant promptly as the work progresses and eliminate any evidence of spillage.

C.4 Curing and Protection

a. Cure the sealants in accordance to the manufacturer's instructions, maintaining a minimum temperature of 40ºF.
b. Installer shall advise the contractor on proper procedures to protect compounds and sealants during the remainder of the construction period, to ensure joints are without deterioration or damage at the time of substantial completion.

C.5 Performance Test.

a. After curing joints, test 5% exterior joints subject to the elements for leaks by applying a stream of water perpendicular from a ¾" hose at normal city water pressure. Repair any leaks and re-test as required.

D Measurement

The department will measure Joint Sealants as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.20	Joint Sealants	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

45. Aluminum Doors and Frames, Section 08 12 00, Item SPV.0105.21.

A Description

A.1 General

This special provision describes all labor and materials for the fabrication, furnishing and installation of heavy-duty flush panel and stile and rail louver panel aluminum doors, extruded aluminum frames and all accessories and all required door hardware as shown on the architectural drawings, inferable there from and specified herein.

The work specified in this section includes:

a. The flush panel exit doors at the northeast and northwest corners of the shed from the north platform to the public areas outside the station.
b. The flush panel access doors to the Elevator Machine Rooms under the escalators on the north, middle, and south platforms.
c. The stile and rail louver panel access doors to the Electrical Rooms on the east side of the Egress Tunnel opposite the stairs under Platforms Nos. 2 and 3.
d. The stile and rail louver panel access door to the Sump Pump Room at the southend of the Egress Tunnel.
e. The flush panel access door to the Data Room within the existing Depot.

A.2 Related Work Specified Elsewhere:

a. Concrete Structures
b. Section 05 40 00 Cold Formed Metal Framing
c. Section 05 50 00 Metal Fabrications
d. Section 07 41 00 Composite Metal Panels
e. Section 07 92 00 Sealants
f. Section 09 21 00 Gypsum Board Assemblies
g. Section 10 20 00 Aluminum Louvers and Vents
h. Section 28 30 00 Electronic Detection and Alarm.

A.3 Quality Assurance:

a. Single Contract Responsibility: Subcontract the aluminum doors and frames to a single firm, hereinafter referred to as the door contractor, who has specialized for a period of not less than 5 years in the installation of flush panel aluminum doors and frames.
b. Coordinate the door installation with Aluminum Louvers and Vents on the northeast and northwest corners and the shed, and with Composite Metal panels to the Elevator Machine Rooms.
c. Coordinate the door fabrication and installation on the northeast and northwest Emergency Exit Doors with the Electronic Detection and Alarm System.
d. Comply with Standard Specifications for Aluminum and Aluminum Alloy sheet, plate and extruded bars, rods, tubes –ASTM B 209 and ASTM B 221.

A.4 Submittals

a. Contractor shall submit shop drawings, showing the construction of all parts of the work, including metal thicknesses, methods of joining, details of field connections and anchorage, fastening and sealing methods and metal finishes.
b. Relationship to other work shall be clearly indicated. No work shall proceed with fabrication until shop drawings have been reviewed and accepted by the architect.
c. Contractor shall submit finished color samples of frame and door panel sections, with any visible fasteners.
d. Provide manufacturer's maintenance manual and parts list prior to the completion of the work

A.5 Product Handling:

a. Deliver fabricated door and frame units to the project site completely identified in accordance to the erection diagrams.
b. Store in accordance to the manufacturer's instructions above grade, on dunnage properly protected from weather and construction activity.

A.6 Warranties:

a. The contractor shall warrant the doors for 3 years the satisfactory performance of the entire installation, including anchorage, with any deficiencies during the warranty period corrected by the contractor at his expense.
b. The Manufacturer shall warrant the doors with a polystyrene core for 10 years and the fluoropolymer painted finish for 20 years. The door closers shall carry a manufacturer's 10 year warranty and the locksets and exit devices a 3 year limited warranty.

B Materials

B.1 Acceptable Manufacturers:

a. The products outlined in this specification are not the exclusive property of any manufacture. This is a performance specification.

B.2 Aluminum Door Frames:

a. Extruded aluminum 6063-T5 or 7063-T6 in accordance to ASTM B 209 sheet and ASTM B 221 extrusions, in sizes, shapes and profiles indicated on the Contract Drawings and a wall thickness of 0.125".
b. Vertical frame jambs and mullions shall be the full height of openings.
c. Exit Door Frames shall be fabricated to incorporate the electronic alarm hardware and wiring.
d. Fasteners, where exposed shall be aluminum or stainless steel, finished with the frames. Insulate between aluminum and steel or concrete to prevent galvanic action.

B.3 Aluminum Flush and Louver Door Panels

a. Extruded aluminum 6063-T5 main frame consisting of 3/16" thick wall thickness stiles and top and bottom rails, 6 " wide for doors 1 3/4" thick.
b. Main frame joinery shall be mortise and tenon secured with two 3/8" tie rods in the head rail and one 3/8" tie rods in the bottom rail.
c. Main frame shall be reinforced to receive concealed rod panic device and overhead concealed closer in the exit doors, the lockset stile in the Utility Room doors and the hinge stile and on all the doors.
d. Door panels shall be heavy gauge 0.063 smooth sheet aluminum ASTM B 5005 alloy in H15 or H34 temper over 1/8" thick 100% fiber glass backing and a 25 psi density polystyrene infill core with a flame spread rating of not more than 25, contained by an extruded aluminum perimeter edge trim.

e. Louver panels shall be 1 inch deep with 0.050 chevron blades, not more than 1/2" o.c. and an aluminum wire mesh insect screen.
f. Hardware Reinforcing Steel: ASTM A 924/A 924 M galvanized to a minimum G90 and ASTM A 36/A3 6M galvanized.

B.4 Aluminum Finish

a. Door frames and door panels shall receive a fluoropolymer coating 70% PVDF conforming to AAMA 605 02-92 in custom colors to be selected by the architect.
b. The Elevator Machine Room doors will be a "primary blue" to match the Composite Metal Panels. The Tunnel Utility Room Louver Doors and the Flush Exit and Access Doors shall receive a "white" finish to be selected by the architect.

B.5 Finished Hardware

B.5.1 Exit Doors: (Pairs) Hardware Set No. 1

a. Heavy Duty, High Frequency continuous concealed hinges, Type 304 Stainless steel, US 32 D.
b. Concealed Vertical Rod Panic devices (2) for mortise key entry with dogging option US 32D equivalent to: Von Duprin 55 Series, Dor-o-Matic 1990 Series, Corbin-Russwin ED 7800 Series.
c. Overhead Concealed Closers (2) with Hold Open , aluminum finish equivalent to: LCN 2030, Dorma ITS 96, Rixon 0700 Series.
d. Recessed Exterior Pulls (2): Concealed mounting, flush cup on each door leaf US 32.
e. Stainless steel 6" kick plates on both sides.
f. Aluminum Threshold to match the width of the door frame

B.5.2 Elevator Machine Room Doors: (Pairs) Hardware Set No. 2

a. Heavy Duty, High Frequency continuous concealed hinges, Type 304 Stainless steel, US 32 D.
b. Bored Tubular Dead Bolt on active leaf, high security cylinder UL 437 - ANSI E 2171 in US 26D.
c. Overhead Surface Mounted Closer with Hold Open, on the push side of the active leaf, aluminum finish equivalent to: LCN 4010T, Dorma Series ED 600, Corbin/Russwin Series 2000
d. Manual Top and Bottom Surface Bolts on inactive leaf ANSI/BHMA A 156.16 L84161, 18" long in US 26 D
e. Recessed Exterior Pulls (2): Concealed mounting, flush cup on each door leaf US 32.
f. 3” wide abrasive cast aluminum safety nosing as specified in Section 05 55 00 cast into concrete edge from wall to wall of door openings

B.5.3 Egress Tunnel Sump Pump Room Doors (Pairs) Hardware Set No. 3

a. Heavy Duty , High Frequency continuous concealed hinges, Type 304 Stainless steel, US 32 D.

b. Bored Tubular Dead Bolt on active leaf, high security cylinder UL 437 - ANSI E 2171 in US 26D.
c. Manual Top and Bottom Surface Bolts on inactive leaf ANSI/BHMA. A 156.16 L84161, 18" long in US 26 D
d. Recessed Exterior Pulls (2): Concealed mounting, flush cup on each door leaf US 32.
e. 3" wide abrasive cast aluminum safety nosing as specified in Section 05 55 00 cast into concrete edge from wall to wall of door openings.

B.5.4 Egress Tunnel Electrical Rooms Doors (Pairs) Hardware Set No. 4

a. Heavy Duty, High Frequency continuous concealed hinges, Type 304 Stainless steel, US 32 D.
b. Surface Vertical Rod Panic device (1) on active leaf only for mortise key entry outside trim ANSI 03 with dogging option US 32D equivalent to: Yale 2110; Corbin/Russwin ED6400.
c. Overhead Surface Mounted Closer with Hold Open, on the push side of the active leaf only, aluminum finish equivalent to: LCN 4010T, Dorma Series ED 600, Corbin/Russwin Series 2000
d. Manual Top and Bottom Surface Bolts on inactive leaf ANSI/BHMA A 156.16 L84161, 18" long in US 26 D
e. Recessed Exterior Pulls (2): Concealed mounting, flush cup on each doorleaf US 32.
f. 3" wide abrasive cast aluminum safety nosing as specified in Section 05 55 00 cast into concrete edge from wall to wall of door openings.

B.5.5 Data Room Door (Single) Hardware Set No. 5

a. Heavy Duty , High Frequency 1 1/2 pair mortised butt hinges, Type 304 Stainless steel, US 32 D.
b. Cylindrical Lockset, Lever Handle ANSI F 86 in US 26 D equivalent to Schlage AL Series "Jupiter".
c. Overhead Surface Mounted Closer with Hold Open, on the push side of the active leaf only, aluminum finish equivalent to: LCN 4010T, Dorma Series ED 600, Corbin/Russwin Series 2000
d. Floor Door Dome Stop: US 26

C Construction

C.1 Fabrication

a. All notching to be done prior to application of the material final finish to ensure complete seal and coating of all surfaces.
b. All exposed surfaces to be fine satin finish prior to application of paint finish to eliminate extrusion die marks and fabrication marks.
c. Factory assemble components to the greatest extent possible. Disassemble components only as necessary for shipment and installation.

C.2 Installation

a. Verify that substrate conditions and the actual dimensions of openings are acceptable for installation.
b. Verify that exit doors alarm system rough-in wiring has been installed.
c. Prior to leaving the factory, doors and framing shall be assembled and hung. At this time adjustment shall be made to provide proper perimeter clearance between doors and frame, and all conditions between doors, frame and finish hardware shall be tested.
d. All materials shall be installed by factory-trained erectors in strict accordance with installation date provided by the manufacturer and these specifications.
e. Perform any cutting, drilling and fitting required, setting accurately in location, alignment and elevation with edges and surfaces level, plumb, true and free of rack.
f. Anchor securely using built-in anchor bolts or expansion bolts designed for the intended use, normal thermal movement and wind loads.

C.3 Protection and Cleaning

a. Protect paint finish from damage during construction with temporary protective coverings and restore any finish that may have been damaged, leaving no evidence of repair.
b. When construction work has been completed, remove protective coverings and clean the doors and frames as recommended by the manufacturer for the type of finish.
c. Adjust doors and hardware for correct function and smooth operation.

D Measurement

The department will measure Aluminum Doors and Frames as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.21	Aluminum Doors and Frames	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

46. Aluminum Window Wall, Section 08 41 00, Item SPV.0105.22.

A Description

A.1 General

This special provision describes the labor and materials for the fabrication, furnishing and installation of an aluminum window and louver wall system complete with extruded aluminum framing, glass, hardware and all accessories and all required components as shown on the architectural drawings, inferable there from and specified herein.
The work specified in this section includes:

a. The window wall and louver framing on the north side of the Train Shed.
b. The louver framing on the south side of the Train Shed.
c. The window wall over the flat end roof trusses on the east and west sides of the Train Shed.
d. The louver framing over the east and west Exit Doors between the Train Shed and the Station Building.
e. The work also includes the installation of the infill louvers within the window wall framing which are supplied by others and specified under Section 10 20 00.

A.2 Related Work Specified Elsewhere:

a. Concrete Structures
b. Section 05 12 00 Structural Steel Framing
c. Section 05 50 00 Metal Fabrications (In particular the Roof Guard Rail)
d. Section 07 61 00 Sheet Metal Gutter and Flashing
e. Section 07 92 00 Sealants
f. Section 10 20 00 Aluminum Louvers and Vents.

A.3 Quality Assurance:

a. Single Contract Responsibility: Subcontract the aluminum window and louver wall and frames to a single firm, hereinafter referred to as the window wall contractor, who has specialized for a period of not less than 5 years in the installation of window wall systems equivalent to those specified.
b. Coordinate the window wall installation with Aluminum Louvers and Vents on the north and south sides of the shed, and the northeast and northwest corners where the shed abuts the Station Building.
c. Coordinate the installation with the Roof Guard Rails on the north and south sides of the shed.
d. Comply with Standard Specifications for Aluminum and Aluminum Alloy sheet, plate and extruded bars, rods, tubes –ASTM B 209 and ASTM B 221.
e. Provide test reports from AAMA accredited laboratories certifying the performances specified below under Subsection 5 accompanied by the window wall manufacturer letter of certification stating the tested system(s) meet or exceed the specified criteria.

A.4 Submittals

a. Contractor shall submit shop drawings, showing the construction of all parts of the work, including metal thicknesses, methods of joining, details of field connections and anchorage, fastening and sealing methods and metal finishes.
b. Relationship to other work shall be clearly indicated. No work shall proceed with fabrication until shop drawings have been reviewed and accepted by the architect.
c. Contractor shall submit finished color samples of frame, glass and glazing gaskets and any visible fasteners.
d. Provide test reports, structural calculations, warranties and manufacturer's maintenance manual prior to the completion of the work

A.5 Performance and Testing Requirements

a. Window wall framing system shall be designed to provide for thermal movement of all component materials resulting from surface temperatures ranging from + 120 degree F to - 40 degrees F without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects
b. Structural Performance: Provide systems, including anchorage, capable of withstanding. 15.0 psf positive and 15.0 psf negative design wind pressure normal to the plane of the wall.
c. Main-Framing-Member Deflection: Limited to 1/175 of clear span or 1/4 inch, whichever is smaller.
    i. Structural Testing: Systems tested according to ASTM E 330 at 150 percent of inward and outward wind-load design pressures do not evidence material failures, structural distress, deflection failures, or permanent deformation of main framing members exceeding 0.2 percent of clear span.
    ii. Water Penetration: Systems do not evidence water leakage when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward acting wind load design pressure but not less than 12.0 psf.

A.6 Product Handling:

a. Deliver fabricated window and louver wall frame units to the project site completely identified in accordance to the erection diagrams.
b. Store in accordance to the manufacturer's instructions above grade, on dunnage properly protected from weather and construction activity.

A.7 Warranties:

a. The manufacturer shall warrant the window walls for 3 years the satisfactory performance of the entire installation, including anchorage, with any deficiencies during the warranty period corrected by the Manufacturer at his expense.
b. The manufacturer shall warrant the fluoropolymer painted finish for 20 years.

B Materials

B.1 Basis for Design Product:

The design for the window/louver wall is based on:

a. 400 Series Curtain Wall by Tubelite Inc, Walker MI (800) 866-2227. Subject to compliance with the requirements, details and these specifications a comparable product by one of the following will be given consideration:
b. Wausau Window and Wall Systems, Wausau, WI (877) 678-2983
c. Kawneer Co. Inc., Norcross , GA (877) 767-9107

B.2 Aluminum Framework:

a. Aluminum Extrusions, alloy 6063 – T5 or 7063 - T6 in accordance to ASTM B 209 sheet and ASTM B 221 extrusions. Sizes, shapes and profiles as indicated on the Contract Drawings.
    i. Reinforcing Steel: ASTM A 36/A3 6M galvanized to a minimum G 90.

B.3 Clear Glass:

a. All glass shall be SIGMA classification, consisting of tempered Plate or Float Glass or laminated units necessitating a Polyvinyl butyl interlayer, Type I Class, quality Q3 to meet the requirements of ANSI Z97.1 - 1984 and CPSC 16 CFR 1201.
    i. Locate tong marks along an edge which will be concealed in the glazing system.
    ii. Tempered glass to increase the flexural strength 4 to 5 times before treatment with the probability of breakage due to anticipated thermal and wind loads not to exceed 8/1000 for vertical lights.
    iii. Laminated glass units shall be guaranteed for a period of 10 years not to develop material obstruction of vision, as a result of dust, or film formation on the internal glass surfaces caused by the failure lamination film.
b. Glazing Strips shall be roll-in wedge high quality extruded elastomeric, EPDM both inside and outside. Color: Black
c. Setting Blocks: Extruded Type II silicone rubber, hardness ASTM D2240 Type A 80 +/- 5 durometer.
d. Sealants and Joint Fillers: For joints at perimeter of systems as specified in Division 7 Section 07 92 00 – Joint Sealants
e. Fasteners and Accessories: Compatible with adjacent materials, corrosion-resistant, nonstaining, and nonbleeding. Use concealed fasteners.

B.4 Finish:

a. Complying with NAAMMs “Metal Finishing Manual fort Architectural and Metal Products” Fluoropolymer Coating, 70% PVDF conforming to AAMA 605-02-92 in a "white" color to be selected by the architect.

C Construction

C.1 Fabrication

a. Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide sub-frames and reinforcing of types indicated or, if not indicated, as required for a complete system.
b. All exposed work shall be carefully matched to produce continuity of line and design with all joints. Raw edges shall not be visible. \
c. Frame dimensions shall be as indicated on the architectural drawings.
d. All exposed surfaces to be fine satin finish prior to application of material finish to eliminate extrusion die marks and fabrication marks.
e. Finish: Chemically cleaned for organic coating fluoropolymer system
f. Factory assemble components to greatest extent possible.

C.2 Installation

a. Use only skilled tradesman to implement the work in full compliance with the accepted shop drawings and specifications

b. Isolate aluminum surfaces in contact with incompatible metal or corrosive substrates, by painting contact surfaces with bituminous coating or primer or by applying sealant or tape recommended by the manufacturer.
c. Anchor window wall system to maintain permanent position when subjected to thermal movement, building deflections, and wind loads.
d. Install framing components true in alignment to the following tolerances:
    i. Variation from plane: Limit to 1/8" in 12 feet.
    ii. Alignment: For surfaces abutting in line, limit to 1/32"; for surfaces meeting at corners, limit offset to 1/32".
    iii. Diagonal Measurements: Limit difference between diagonal measurements to 1/8".
e. Install glass as detailed in the Contract Drawings using pressure plates and covers on the horizontal framing members and silicone glazed verticals.
f. Install louvers as detailed in the Contract Drawings using pressure plates and covers on both the horizontal and vertical framing members.
g. Apply sealing materials to provide a weather tight, smooth finish installation at all joints and intersections in strict accordance with manufacturer's printed instruction and only by mechanics trained and experienced in their use.

C.3 Protection and Cleaning

a. Protect paint finish from damage during construction with temporary protective coverings and restore any finish that may have been damaged, leaving no evidence of repair.
b. When most of the construction has been completed, remove the protective coatings on the window wall system and clean the aluminum, glass and louvers as recommended by the manufacturer for the type of finish.

D Measurement

The department will measure Aluminum Window Wall as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.22	Aluminum Window Wall	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

47. Automatic Entrance Doors, Section 08 46 00, Item SPV.0105.23.

A Description

A.1 General

This special provision describes the labor and materials for the fabrication, furnishing and installation of aluminum and glass automatic sliding doors, transom and sidelights system complete with extruded aluminum framing, insulated glass, hardware, operators and

actuating controls devices and all accessories and all required components as shown on the architectural drawings, inferable there from and specified herein.
The work specified in this section includes:

a. The entrance doors and side-lights connecting the Station Building and the Train Shed.
b. The system shall be completely engineering, manufactured and assembled in factory, tested and adjusted.
c. No field wiring or operator adjustment shall be required other than connection to power and fine tuning of door speeds.

A.2 Comply with Standard Specifications for:

a. Aluminum and Aluminum Alloy sheet, plate and extruded bars, rods, tubes – ASTM B 209 and ASTM B 221.
b. Carbon Structural Steel – ASTM 36 / A36 M
c. Safety Glazing Materials ANSI –Z97.1.2
d. Power Operated Pedestrian Doors ANSI A 156.10
e. Accessibility Standards ANSI A117.1 and local building code.
f. National Electric Code NFPA 70

A.3 System Design:

a. Hold open and close doors under expected wind loads and a temperature range from – 40 F to + 120 F.
b. Door Operators: fully adjustable for speeds, hold open time and cancellation on the activation of fire alarm and smoke detection systems.
c. Coordinate automatic sliding door installation with the required electrical supply specified in Sections under Division 26.

A.4 Related Work Specified Elsewhere:

a. Concrete Structures
b. Section 05 12 00 Structural Steel
c. Section 05 50 00 Metal Fabrications
d. Section 07 92 00 Sealants
e. Sections under Division 26 Electrical

A.5 Quality Assurance:

a. Single Contract Responsibility: Subcontract the doors and sidelight to a single firm, who has specialized for a period of not less than 5 years in the installation of Automatic Door Systems
b. Comply with Standard Specifications for Aluminum and Aluminum Alloy sheet, plate and extruded bars, rods, tubes –ASTM B 209 and ASTM B 221.

A.6 Submittals

a. Contractor shall submit shop drawings, showing the construction of all parts of the work, including metal thicknesses, methods of joining, details of field connections and anchorage, fastening and sealing methods and metal finishes.

b. Relationship to other work shall be clearly indicated. No work shall proceed with fabrication until shop drawings have been reviewed and accepted by the architect.
c. Contractor shall submit finished color sample of frame, glass and glazing gaskets and any visible fasteners.
d. Provide test reports, structural calculations, warranties and manufacturer's maintenance manual prior to the completion of the work

A.7 Product Handling:

a. Deliver fabricated automatic door units to the project site in the manufacturer's original sealed containers, completely identified in accordance to the erection diagrams.
b. Store in accordance to the manufacturer's instructions above grade, on dunnage properly protected from weather and construction activity.

A.8 Warranties:

a. The Manufacturer shall warrant the automatic door system for 3 years the satisfactory performance of the entire installation, including glass, anchorage, operating and control hardware with any deficiencies during the warranty period corrected by the Manufacturer at his expense.
b. The Manufacturer shall warrant the fluoropolymer painted finish for 20 years
c. Insulated glass units shall be guaranteed for a period of 10 years not to develop material obstruction of vision as a result of dust, or film formation on the internal glass surfaces caused by the failure of the hermetic seal.

B Materials

B.1 Automatic Sliding Door System

Automatic Sliding Door System is based on the ESA 400 Series, Fine Frame as manufactured by:

a. Dorma Automatics, Inc., Lake Bluff, IL (877) 367-6211. Subject to compliance with the requirements, the details and these specifications an equivalent product by one of the following will be given consideration:
b. Stanley Access Technologies, Farmington, CT (800) 679-6436
c. Besam Automated Entrance Systems, Monroe, NC (866) 237-2687

B.2 Metals

a. Extruded Aluminum: ASTM B 221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.
b. Sheet Aluminum: ASTM B 209, 5005 alloy, H15 or H34 temper.
c. Reinforcing Steel: ASTM A 36/A3 6M galvanized to a minimum G 90.

B.3 Glazing

a. Sealed double pane insulated Clear Glass: ¼" Fully Tempered Plate or Float Glass units with an interior air spacer, for a total thickness of 1" quality Q3 to meet the requirements of 16 CFR 1201, tempered to increase the flexural strengths 4 to 5 times before treatment. Locate tong marks along an edge which will be concealed in the glazing system.

b. Glazing Strips shall be roll-in wedge high quality extruded elastomeric EDPM both inside and outside; color: black.
c. Setting Blocks: Extruded Type II silicone rubber, hardness ASTM D 2240 Type A 80 +/-5 durometer.

B.4 Operators and Sensors

a. Door Operator and Microprocessor Controller consist of DC permanent magnet motor, a self lubricating drive system and a wear free digital rotary encoder all linked to a digital controller.
b. Motion Sensor shall be bi-directional, detect slow-moving traffic, eliminate radio frequency interference and have the capacity to adjust sensitivity and radius of detection.

B.5 Fasteners and Accessories

a. Concealed and compatible with adjacent materials, corrosion resistant, non-staining and non-bleeding.

B.6 Weather Stripping and Sealants

a. Door system shall include neoprene weather stripping between doors, track and jambs.
b. Sealants and Joint Filler specified in Section 07 92 00.

B.7 Finish:

a. Complying with NAAMM "Metal Finishing Manual for Architectural and Metal Products" Fluoropolymer Coating, 70% PVDF conforming to AAMA 605-02-92 in a "white" color selected by the architect.

C Construction

C.1 Fabrication

a. Narrow stile 1 ¾" deep by-parting sliding door panels with a 7.5" bottom rail, positioned to provide a minimum distance of ¾" at meeting stiles to prevent finger pinch points.
b. Door sliding panels shall allow "breakout" to the full and open position offering egress at any point in the door's movement.
c. Fabricate framing, including jambs and header with 4 ½" deep extrusions with a minimum wall thickness of 1/8".
d. Header shall contain the roller track, door operator and door mounting components under a hinged cover, flush with the top of the header.
e. Threshold tracks shall be provided adjacent to the fixed sidelight panels as a flush extension of threshold under the operating panels.
f. Interior side jambs to contain program switches. Electrical service: 120 VAC, 60 HZ, 5 Amp
g. Locking shall be independent 2 pt locking in each active leaf with exterior key and interior thumb turn.

h. All exposed surfaces to be fine satin finish prior to application of material finish to eliminate extrusion die marks and fabrication marks. Chemically clean for organic coating of fluoropolymer system

C.2 Examination

a. Examine and measure areas to receive doors. Notify the architect of any conditions that would adversely affect installation or subsequent operation of the doors. Do not proceed with installation until unsatisfactory conditions are corrected.
b. Ensure openings to receive frames are plumb, level, square and in tolerance.
c. Ensure proper support has been provided at operator header.
d. Ensure that floor is level and smooth.
e. Ensure that the electric power rough-in has been performed.

C.3 Installation

a. Installation shall be by an installer approved and trained by the manufacturer and in strict accordance with the manufacturer's instructions and installation guide.
b. Isolate aluminum surfaces in contact with incompatible metal or corrosive substrates, by painting contact surfaces with bituminous coating or primer or by applying sealant or tape recommended by the manufacturer.
c. Install doors to be weather tight in the closed position.
d. Anchor sliding door system to maintain permanent position when subjected to thermal movement, building deflections, and wind loads.
e. Adjust door equipment for correct function and smooth operation.
f. Clean doors promptly after installation without the use of harsh cleaning materials and in accordance to the manufacturer's instructions
g. Protect paint finish from damage during construction with temporary protective coverings and restore any finish that may have been damaged, leaving no evidence of repair and ready to receive finish coats of paint.

D Measurement

The department will measure Automatic Entrance Doors as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.23	Automatic Entrance Doors	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

48. Metal Framed Skylights, Section 08 63 00, Item SPV.0105.24.

A Description

A.1 General

This special provision describes the fabrication, delivery and installation of aluminum framed skylights - which includes the structural design, engineering and drafting - over the space between the top chords in each of the roof trusses and over the gasket between the Station Building and the Train Shed. The scope of the work covers all related skylight framing, the finish of metal components, all related stainless steel gutters and flashing, skylight glass and glazing and all related accessories and hardware as shown on the drawings, inferable there from and specified herein.

The skylights shall be the product of a single manufacturer installed over steel curbs provided by others, capable of resisting all the loading imposed upon the curbs by the skylights.

A.2 Related Sections Specified Elsewhere

a. Section 05 12 50 Architectural Exposed Structural Steel:
b. Section 05 50 00 Metal Fabrications
c. Section 07 61 00 Sheet Metal Gutter and Flashing
d. Section 07 92 00 Sealants

a. A.3 References
b. Aluminum Association Incorporated (AA):SAS-30 Specifications for Aluminum Structures.
c. American Architectural Manufacturers Association (AAMA):
    i. 501.1: Standard Test Method for Metal Curtain Walls for Water Penetration Using Dynamic Pressure.
    ii. 501.2: Field Check of Metal Curtain Walls for Water Leakage.
    iii. 501.3: Field Check of Water Penetration Through Installed Exterior Windows, Curtain Walls and Doors by Uniform Air Pressure Difference.
    iv. 603.8: Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
    v. 605.2: Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
d. American National Standards Institute (ANSI): Z 97.1 -2004- Safety Glazing Materials Used in Buildings -Safety Performance Specifications and Methods of Test.
e. American Society for Testing and Materials (ASTM):
    i. A193: Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.
    ii. A307: Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
    iii. B209: Specification for Aluminum and Aluminum-Alloy Sheet andPlate.
    iv. B211: Specification for Aluminum-Alloy Bar, Rod and Wire.

v. B221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
vi. B316: Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods.
vii. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cycle Movement.
viii. C794: Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants
ix. C1036: Specification for Flat Glass.
x. C1048: Specification for Heat-Treated Flat Glass-Kind HS, Kind FTCoated and Uncoated Glass.
xi. D395: Test Methods for Rubber Property -Compression Set.
xii. D412: Test Methods for Rubber Properties in Tension.
xiii. D1171: Test Method for Rubber Deterioration -Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens).
xiv. D2240: Test Method for Rubber Property -Durometer Hardness.
xv. E283: Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
xvi. E330: Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
xvii E331: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
xviii. E773: Test Method for Seal Durability of Sealed Insulating Glass Units.
xix. E774: Specification for Sealed Insulating Glass Units.
xx. E783: Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

f. Consumer Product Safety Commission (CPSC): 16CFR 1201 -Architectural Glazing Standards and Related Material.
g. Flat Glass Manufacturers Association (FGMA): Glazing Manual.
h. Insulating Glass Certification Council (IGCC): Classification of Insulating Glass Units.

A.4 System Design Requirements

a. Extruded aluminum framing with mechanically fastened pressure bars or structural silicone joints, as applicable.
b. Pressure bars shall employ fasteners that allow removal and replacement without destruction or loss of integrity.
c. Framing members to have integral gutter system for positive drainage of condensation and infiltration to the exterior.
d. Framing rafters shall have offset gutters to ensure space for moisture migration from horizontal to rafter gutter.
e. Framing horizontals shall be attached to rafters with stainless steel roll pins.
f. Framing horizontals shall have capillary cuts to prevent moisture clinging to the bottom of the horizontal.
g. Flush glazed exterior horizontal joints with field applied structural silicone.
h. Full silicone wet seals along both sides of all exterior glass retainers.

A.5 System Performance Requirements

A.5.1 Structural

a. Structural Members of sufficient sizes to support design loads as prescribed by the governing building codes.
b. The deflection of the framing member in a direction normal to the plane of glass when subjected to a uniform load test in accordance to ASTM E330, and per the above specified loads, shall not exceed L/175, up to 1 inch maximum, for clear spans under 20 feet, or L/240 for clear spans greater than 20 feet.
c. The deflection of a framing member in a direction parallel to the plane of glass, when carrying its full dead load, shall not exceed an amount which will reduce the glass or panel bite below 75% of the design dimension and the member shall have a 1/8 inch minimum clearance between itself and the edge of the fixed panel, glass, or component immediately adjacent, nor shall it impair the function of or damage any joint seals.

A.5.2 Water Penetration:

a. No water penetration shall occur when the system is tested in accordance to ASTM E331 using a differential static pressure of 20% of the inward acting design wind load pressure, but not less than 12 psf. Water penetration is defined as the appearance of uncontrolled water other than condensation on the interior surface of any part of the skylight.
    i. Drain water penetrating at joints, as well as condensation occurring within the system to exterior face of work.

A.5 3 Thermal Movement:

a. Provide for such expansion and contraction of component materials as will be caused by a surface temperature range of +/- 85 degrees Fahrenheit, ranging from – 20 degrees F to 150 degrees F and an interior surface temperature range of (+/-) 40 degrees F to 120 degrees F. Adjustments in the exterior and interior temperature ranges should be made, based on specific project locations and conditions. The skylight systems should allow for thermal movements without causing buckling, stress on glass, failure of seals, undue stress on structural elements, reduction of performance or other detrimental effects.

A.5 4 Allowable Loads

a. Where permitted by code, 1 1/3 increase in allowable stress for wind or seismic load shall be acceptable, but not in combination with any reduction applied to combined loads. In no case shall allowable values exceed yield stress.
b. Compression flanges of flexural members may be assumed to receive effective lateral bracing only from anchors to the building structure and horizontal glazing bars or interior trim which are in contact with 50% of the member’s total depth.
c. The skylight framing is designed to be self-supporting between the support construction. The skylights will impose reactions to the support construction. All adjacent and support construction must support the transfer of all loads including horizontal and vertical, exerted by the skylight(s).

d. Design skylight system to accommodate anticipated movement in structural steel support system beneath the skylight(s).

A.6 Submittals

a. Shop drawings showing plans, elevations, sections and details as required to fully describe the skylight construction for the architect's approval prior to starting fabrication.
b. Submit structural calculations prepared in accordance to the Aluminum Association's Specifications for Aluminum Structures (SAS30) by a structural engineer qualified in the design of self-supporting sloped glazed systems licensed in (state where skylight is to be installed)
c. With regard to structural silicone joinery, submit, only if specifically requested:
    i. Certification that adhesion of sealant to samples of metal and glass is adequate when tested in accordance to ASTM C794.
    ii. Certification that materials in contact with sealant are compatible with sealant after being exposed to 2,000-4,000 micro watt ultra-violet radiation for 21 days.
    iii. Statement that stress on each detailed sealant joint will not exceed design stress of sealant when exposed to specified wind loads.
d. Three 12-in. x 12-in. samples of each type of glass.
e. Three manufacturer's samples of each type of sealant and product data
f. Three 6-in. long samples of extrusions (with appropriate finish).
g. As-built drawings and cleaning and maintenance manuals upon completion of skylight installation.
h. Certification that laminated glass units will withstand specified design loads.

A.7 Quality Assurance

a. The skylight manufacturer shall be responsible for the design, fabrication, painting and installation of the skylight assembly.
b. Only factory-trained mechanics shall be utilized for the installation of the skylight.
c. The skylight manufacturer shall be regularly engaged in custom skylight construction of similar projects completed over the past ten years.

A.8 Warranty

a. The system shall be warranted for a period of 10 years from the date of skylight completion against leakage, defective design and defective materials.
b. Glass is warranted per the manufacturer’s standard warranties for a period of ten (10)years regarding delamination and seal failure coating
c. Aluminum finish is warranted for a period of 20 years.
d. Structural sealant for a period of 10 years certifying that cured sealant
    i. Will not become brittle or crack due to weathering or normal expansion and contraction of adjacent surfaces.
    ii. Will not harden beyond a Shore A durometer of 50, nor soften below a minimum of 10 points.

iii. Will not change color significantly when used with compatible back-up materials.
iv. Will not bleed significantly.

B Materials

B.1 Acceptable Manufacturers

Basis of Design Product: The design for the Metal-Framed Skylight Systems is based on

a. Super Sky Products Inc.10301 N. Enterprise Dr, W Mequon, WI 53092 (262) 242 2000
b. Subject to compliance with the specified and detailed requirements a comparable product will be considered by:
c. LinEl Signature,101 LinEl Drive,Mooresville, IN 46158: (317) 831-5314.
d. The Vistawall Group of Butler Manufacturing Co. 750 Airport Rd. Terrell, TX 75160 (800) 527 4018

B.2 Skylight Components

B.2.1 Framework:

a. Principal Supporting Members: .125-in. minimum thickness extruded aluminum, alloy 6005-T5 or 6061-T6 per ASTM B221. Sizes, shapes and profiles as indicated on the Contract Drawings.
b. Snap-on Covers and Miscellaneous Non-supporting Trim: .062-in. minimum thickness extruded aluminum, alloy 6063-T5 per ASTM B221.
c. Supporting steel gutters: thickness as prescribed by skylight engineer, based on skylight reactions and applied design loads.
d. Principal Formed Metal Members: .125-in. minimum thickness aluminum, alloy [5052] [6061-T6] per ASTM B209.

B.2.2 Glazing Strips:

a. Extruded EDPM rubber designed to comply with the following specifications:
    i. Hardness: ASTM D2240, Type A: Durometer 50 (+/-5).
    ii. Tensile Strength: ASTM D412. 800 psi (min.).
    iii. Elongation: 300% (min.).
    iv. Color: Black.
    v. Compression Set: ASTM D395 Method B, 22 hours @ 212 ºF: 25% (max.).
    vii. Heat Aging Characteristics:
        70 hours @ 212 ºF.
        Hardness: ASTM D2240, Type A: Durometer 50 (+/-5).
        Tensile Change: ASTM D412. -10%.
        Elongation Change: ASTM D412: -20%.
    viii. ASTM D1171 Weather Resistance at 1 Part Ozone per Million, 500 hours at 20% Elongation: No cracks.
    ix. No visual checks, cracks or breaks after completion of tests.

B.2.3 Setting Blocks:

a. Extruded Type II silicone rubber designed to permit adhesion and comply with the following specifications:
    i. Hardness: ASTM D2240, Type A: Durometer 80 (+/-5).
    ii. Color: Black.

B.2.4 Fasteners:

a. For Exterior Cap Retainers: ASTM A193 B8 300 series stainless steel screws.
b. For Framework Connections: ASTM B211 2024-T4 aluminum, ASTM A193 B8 300 series stainless steel, and ASTM B316 aluminum rivets, as required by connection.
c. For Anchoring Skylight to Support Structure: ASTM A307 zinc plated steel fasteners.
d. Exposed stainless steel truss head mechanical fasteners are utilized in accordance to standard connection details.

B.3 Flashing:

a. 5005 H34 Pre-painted Aluminum, .040-in. minimum thickness.
b. Sheet metal flashings/closures/claddings are to be furnished shop formed to profile in min. 10-foot lengths. When lengths exceed 10-foot, field trimming of the flashing and field forming the ends is necessary to suit as-built conditions. Sheet metal ends are to overlap 6-in. to 8-in. minimum, set in a full bed of sealant and riveted if required.

B.4 Finish

a. Exposed metal finish interior and exterior to comply with the following:
    i. High Performance Pigmented Organic Coatings: AAMA 2605-05 2-coat min. 70% PVDF fluoropolymer.
    ii. Color shall be a standard “white “ color as selected by the architect.

B.5 Glass:

a. Standard Certification Requirements:
    i. Heat Treated Glass: ASTM C1048, with surface stress of 5,000 (+/-) 1500 psi.
    ii. Laminated Glass: Two lites interleaved with polyvinyl butyal (PVB). Units must meet criteria of ANSI Z97.1- 1984 and CPSC 16 CFR 1201 for safety glazing. Provide PVB layer of 0.060-in. for all glass units to accommodate a frit applied to the inside face of the laminate.
b. Performance Requirements:
    i. Probability of breakage not to exceed 8/1000 for vertical glass and 1/1000 for sloped glass upon first application of design wind and live load pressures. For glass selection, design wind pressure for a one minute duration. For loads of longer duration use standard engineering practices for glass selection.
    ii. Probability of breakage due to anticipated thermal stress not to exceed 8/1000 for vertical glass and 1/1000 for sloped glass.

B.5.1 Glazing Unit Composition:

a. Basis of design: Viracon clear heat strengthed laminated glass with .060 clear PVB interlayer and Viraspan design silk screen pattern #2002. Pattern shall have 50% coverage, 1/8" lines x 1/8" space. x V175 white frit color. Thickness as required by analysis, frit pattern shall run east/west as shown on contract drawings.
b. Subject to compliance with the specified and detailed requirements a comparable product will be considered by:
    i. PPG Industries, Cheswick, PA (800) 377-5267
    ii. Approved equal.

B.5.2 Sealants:

a. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance to manufacturer's recommendations.
b. Non-structural Flush Glazed Joints and Weather Seal Joints: Silicone sealants applied in accordance to manufacturer's recommendations.
c. Structural silicone sealant performance requirements:
    i. Hardness: ASTM D2240 Type A, 30 durometer.
    ii. Ultimate Tensile Strength: ASTM D412, 170 psi.
    iii. Tensile at 150% Elongation: ASTM D412, 80 psi.
    iv. Joint Movement Capability after 14 Day Cure: ASTM C719, (+/-) 50%.
    v. Peel Strength (aluminum, glass, concrete) after 21 Day Cure: ASTM C794, 50 ppi.
    vi. Color: Manufacturer's standard as selected by the architect.
d. Perimeter Flashing Sealant:
    i. Hardness: TT-S-00230C Shore "A" 25 +/- 5 Durometer.
    ii. Tensile Strength: ASTM D412-80 180 psi.
    iii. Adhesion-in-Peel: TT-S-00230C 20-28 lbs./in.
    Ultimate Elongation: ASTM D412-80 550%.

C Construction

C.1 Fabrication

a. Construct skylights using a continuous aluminum curb with expansion joints as required.
b. Fitting and assembly of the work shall be done in the manufacturer's shop, insofar as is practicable. Work which cannot be permanently assembled, shall be shop assembled, marked and disassembled before shipment to the job site.
c. All visible welds shall be smooth and continuous and ground to a 100-grit finish for a painted project.
d. Design rafter bars for slide-in type spline glazing strips.
e. Design glass retainer fasteners to resist uplift loadings. Spacing to be determined by structural calculations.
f. Use snap-on type caps to conceal glass retainers and glass retainer fasteners.
g. Where applicable shop locate drill and bolt, rivet or weld aluminum clips to framing members or field bolt at installation.

h. Set glass with exterior EPDM glazing strips. Use silicone setting blocks to support glass and to provide proper edge clearances and glass bites, in accordance to FGMA recommendations.
i. Set blocks not less than 6 in. from edge of glass for support unit.
j. Glass bite, not less than ½ in. nor more than 5/8in on any side of glass unit.
k. Maintain ¼ in edge clearance between glass and adjacent metal framework.
l. Use rubber spacers to maintain separation of glass and adjacent metal framework.
m. Locate weep holes in curb to positively drain condensation to exterior of skylight at each rafter connection.

C.2 Installation

C.2.1 Examination

a. Upon arrival to the jobsite for installation of the specified work, the manufacturer's erector is to examine the structure and substrate to determine that they are properly prepared, dimensionally accurate, and ready to receive the skylight work included herein. Report any discrepancies to the general contractor. Correction of faulty work to be at the expense of the responsible party/s. The skylight manufacturer is not responsible for faulty structure or substrate.
b. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for the prevention of electrolytic action and corrosion.

C.2.2 Erection

a. The skylights shall be erected and glazed by an experienced and authorized installer familiar with the manufacturer's systems and installation procedures, and under the direction of the manufacturer's mechanics and in accordance to the manufacturer's instructions.
b. Erect system plumb and true, in proper alignment and relation to established lines and grades as shown on approved shop drawings.
c. Anchor skylight to structure in strict accordance with approved shop drawings.
d. Use high performance silicone sealants to seal horizontal joints between glass panels and silicone sealant to wet seal joints between snap-on cap retainers and glass.
e. Apply sealing materials in strict accordance with sealant manufacturer's instructions. Before application, remove mortar dirt, dust, moisture and other foreign matter from surfaces it will contact. Mask adjoining surfaces to maintain a clean and neat appearance. Tool sealing compounds to fill the joint and provide a smooth finish.

C.3 Tolerances

a. Maximum variation from plane or location shown on approved shop drawings: 1/8-in. per 12-foot length, or 1/2-in. in total length
b. Maximum offset from true alignment between two members abutting end-to-end edge-to-edge in line or separated by less than 3-in:1/32-in."

C.4 Field Quality Control

a. Sealant Adhesion: After sealant is fully cured (14 to 21 days) perform sealant adhesion in strict accordance with sealant manufacturer's prescribed procedures.
b. Water Leakage: Field check in accordance to AAMA 501.2 in proportionate areas. There shall be no uncontrolled water leakage as defined in AAMA 501.2. Water supply to the skylights, with adequate water pressure, is to be furnished by the general contractor. Tests are to be conducted upon completion of the installation with no remobilization or down time included to accommodate either water supply availability or witness personnel schedules. Testing is to be performed by the manufacturer's authorized personnel with a maximum of 5 man-hours for set-up, testing and clean-up. Independent laboratory testing and reports, if required, are to be ordered and directed by the owner and/or general contractor.
c. Water Penetration: Field test in accordance to AAMA 501.3, at an air pressure difference equal to 20% of the positive design wind pressure with a minimum of 6.24 psf and a maximum of 12.0 psf

C.5 Cleaning

a. Install skylight frame and associated metal to avoid soiling or mudging the finish.
b. Clean glass and frame at time of installation. Final cleaning, if required, subsequent to completion of project, to be performed by the manufacturer.

C.6 Protection

a. Protection of the skylight from ongoing work by other trades shall be the responsibility of the general contractor.

D Measurement

The department will measure Metal Framed Skylights as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.24	Metal Framed Skylights	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

49. Gypsum Board Assemblies, Section 09 21 00, Item SPV.0105.26.

A. Description

A.1 General

This special provision describes all labor and materials for the furnishing and installation, taping and finishing of Exterior, water resistant and glass mat reinforced Sheathing Board, Interior Type X - VHI Abuse-Resistant gypsum board and Cement Board for

exterior walls and interior wall enclosures and ceilings as shown on the drawings, inferable there from and specified herein.
The sheathing of walls and ceilings shall include:

a. The exterior sheathing under the corrugated metal panel south wall.
b. The exterior sheathing under the composite metal panel cylindrical elevator hoist ways.
c. The exterior sheathing under the composite metal panel Elevator Machine Rooms under the escalators.
d. The exterior sheathing with cement board on the curbs of the skylights.
e. The interior sheathing with cement board of the square elevator shaft ways
f. The interior sheathing with cement board of the elevator machine rooms walls and ceilings under the escalators.
g. The interior sheathing with High Impact Resistant, Type X wallboard to finish the installation of the automatic doors in the existing station building.
h. The interior sheathing with High Impact Resistant, Type X wallboard on the enclosure and partition repairs to the new Data Room within the Depot Building.

A.2 Qualifications:

a. Comply with the applicable requirements of ASTM C840 "Application and Finishing of Gypsum and Cement Base Wallboard".
b. Provide materials identical to assemblies tested to UL Standard 2079, ASTM E 119.
c. Coordinate sheathing and wall board work with Section 05 40 00 Cold Formed Metal Framing.

A.3 Delivery, Storage and Handling:

a. Protect Materials from soiling and damage, and deliver to the project site, fully identified with name, brand, type and grade, without undue exposure to the weather. Store level in a dry, ventilated space, off the ground, handling material to protect against damp or wet surfaces, exposure to weather and damage to edges.

A.4. Project Site Conditions:

a. Do not start installation of gypsum board and cement products when outside temperatures are below 55 degrees F., unless the work area is enclosed and heated to maintain a continuous and uniform temperature of not less than 55 degrees F. for one week prior to beginning of joint treatment and until joint treatment is completed and thoroughly dry. Provide ventilation, either natural or supplied by fans, to remove excess moisture during joint treatment.
b. Avoid conditions that will create moisture in the air and condensation on the walls.

A.5 Submittals

a. Product Data for information only
b. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to assemblies tested according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

A.6 Related Work Specified Elsewhere

a. Section 05 40 00 - Cold Formed Metal Framing
b. Section 05 50 00 - Metal Fabrications
c. Section 07 21 00 - Building Insulation
d. Section 07 41 00 - Composite Metal Panels
e. Section 07 46 00 - Corrugated Metal Panels
f. Section 08 12 00 - Aluminum Doors and Frames
g. Section 08 46 00 - Automatic Doors and Frames
h. Section 09 91 00 - Painting

B Materials

B.1 Metal Framing.

Refer to Specification Section 05 40 00 – Cold Formed Metal Framing and comply with ASTM C 645 and ASTM A 653 , G 49 for hot-dipped galvanized coating.

B.2 Sheathing, Gypsum and Cement Wallboards.

Sheathing, Gypsum and Cement board products in maximum lengths available to minimize end-to-end butt joints: Furnish all panel , accessories and joint treatment materials from one of the following manufacturers:

a. UNITED STATES GYPSUM CO. “Sheetrock”,”Fiberock” VHI Abuse-Resistant, and “Fiberock Aqua Tough Sheathing” (800) 874-4986
b. CERTAIN TEED CORP. “ProRoc”, “Pro-Roc” Abuse Resistant and GlasRock Sheathing” (800) 233-8990
c. G P GYPSUM CORP. “GyProc Products”, “Tough-Rock Abuse- Resistant and “DensGlass Gold” Exterior Sheathing (800) 876-4746

B.3 Panel Products:

a. Exterior Sheathing Board: Gypsum Sheathing manufactured in accordance to ASTM C 1177 with glass mats on both sides and long edges and a water-resistant treated core. Exterior sheathing shall be 5/8”, Type X as defined by ASTM C 1396..
b. Interior Wallboard:Mold and High Impact Abuse-Resistant Wallboard: ASTM C 1396 36 - 5/8” thick meeting the requirements of Type X with manufacturer’s standard edges equivalent to US Gypsum
c. "Mold Tough AR".
d. Exterior Cement Board: exceeding ANSI A 118.9 and ASTM C 1325 , ½” and 5/8” thick equivalent to U.S. Gypsum "Durock" Brand Exterior .

B.4 Exterior Sheathing Wall Accesories.

a. Rust-resistant bugle or wafer head self tapping screws.
b. Joint tape: 2" wide 10 x 10 glass mesh tape with sheathing manufacturer's joint compound.
c. Trim Cornerbead, edge trim, and control joints complying with ASTM C 1047, formed from steel sheet zinc coated by hot-dip process or rolled zinc.

d. Water Resistant membrane: Taped, non-woven and non-perforated Spunbonded Olefin, with corrugated vertical coursing surface to provide a water penetration resistance of 200cm minimum AATCC 127.

B.5 Gypsum Wall Board Accessories:

a. Fasteners: Type S or s-12 corrosion resistant coating, self-drilling screws with head and length applicable to the assembly of framing and /or the installation of gypsum board panels.
b. Trim: Cornerbead, edge trim, and control joints complying with ASTM C 1047, formed from steel sheet zinc coated by hot-dip process or rolled zinc.
c. Board Joint Treatment Materials: Comply with ASTM C 475. Paper reinforcing tape and setting-type taping compound and drying-type, ready-mixed, compounds for topping.
d. Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834.
e. Ceiling access doors: Flush, zinc coated and prime painted steel, self latching units with trimless frame with flanges for gypsum board installation.
    i. 18” x 24” – 20 gauge steel , welded pan with fully concealed hinge n a 16 gauge frame to open 175 degrees.
    ii. Heavy duty latches, flush mounted and screw driver cam operated.
f. Resilient Wall Base: 6” high, toeless , 1/8” thick , ASTM F 1861-98 smooth rubber in color to be selected by the architect, using low emitting, solvent free, water resistant adhesive.

B.6 Cement Board Accessories:

a. Fasteners:No. 8, 1 1/4" and 1 5/8" corrosion resistant steel screws for 14 - 20 gauge steel framing
b. Joint Reinforcement: 4" wide alkali-resistant tape equivalent to "Durock" brand exterior tape.
c. Joint Treatment: Comply with ASTM C 472 setting type taping compound and drying type, ready mixed for topping.

C Construction

C.1 Installation of Exterior Gypsum Sheathing.

a. Examine framing and verify that framing members do not vary more than 1/8” from the placement of adjacent members.
b. Install sheathing with exterior face side out, using maximum lengths and full accordance with manufacturer’s instructions and ASTM C 1280.
c. Attach sheathing to metal framing with screws spaced a maximum of 8” o.c. at perimeter where there are framing supports, and a maximum of 8” o.c. along intermediate framing in field, locating screws not less than of 3/8” from the edges and ends of panels. Drive fasteners to bear tight and flush with surface of sheathing. Do not countersink.
d. Apply fiberglass mesh joint tape over joints and embed in manufacturer’s recommended setting type joint compound, leaving installation ready to receive Weather Resistant Barrier

e. Install water resistant membrane against the exterior face of the exterior gypsum sheathing, extending from the underside of the clerestory louver framing to where the membrane overlaps the wall flashing at the base of the wall and all wall openings by at least 4 inches.
    i. Ensure that the membrane corrugations face out
    ii Overlap membrane joints and seal joints and penetrations through the membrane as recommended by the manufacturer. The installation shall be air-tight and free from holes, tears and punctures.

C.2 Installation of Cement Board and Gypsum Wallboard

a. Verify that the installed steel framing to complies with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
    i. Ensure that non-bearing partition steel framing is isolated from building structure, except at floor, to prevent structural movement from transferring loading to partitions.
    ii. Ensure mineral wool insulation has been installed in exterior stud wall cavities where indicated on the Drawings.
    iii. Ensure that all required conduit, piping and ductwork within walls and above ceilings have installed.
b. Install and finish cement board and gypsum panels to comply with ASTM C 840 and GA-216.
c. Isolate the perimeter of non-load-bearing gypsum board and cement board partitions where they abut structural elements, except floors, by providing a 1/4- to 1/2-inch- wide space between gypsum board and the structure. Trim edges with J-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
d. Single-Layer Fastening Methods: Fasten gypsum and cement board panels to supports with screws.
e. On all exposed surfaces: Level 4 finish, unless otherwise indicated. Embed tape and apply separate first, fill and finish coats of joint compound to tape, fasteners and trim flanges.
f. At concealed areas, unless a higher level of finish is required for fire resistance rated assemblies, provide Level 1 finish. Embed tape at all joints.

C.3 Protection and Cleaning

a. Clean-Up. Remove gypsum sheathing, gypsum wallboard and cement board debris and leave floors broom clean. Excess material, scaffolding, tools and other equipment shall be removed at the completion of the work.
b. Protect and maintain the gypsum sheathing work until the weather resistant barrier, and metal panel cladding are installed.
c. Protect and maintain the gypsum wallboard and cement board through the construction period, so that it will be without any indication of damage at the time of substantial completion and acceptance.

D Measurement
The department will measure Gypsum Board Assemblies as a single lump sum unit of work, acceptably completed.

E. Payment
The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.26	Gypsum Board Assemblies	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

50. Detectable Warning Tiles, Section 09 30 50, Item SPV.0105.27.

A Description
A.1 General
This special provision described the labor and materials required for the fabrication, furnishing and installation of ADA Complying Cast-in-Place Detectable/Tactile Warning Tiles, reinforced epoxy polymer, and all accessories required at all stair landings as shown on the architectural drawings, inferable there from and specified herein.

A.2 Detectable Warning Tile System
The Detectable Warning Tile System will be installed on:
a. All Mezzanine access stair landings to indicate a change of level.
b. All Egress Tunnel stair landings to indicate a change of level.

A.3 Related Work
Concrete Structures
a. Section 05 55 00 Metal Stair Nosings.
b. Section 07 92 00 Joint Sealants.

A.4 Submittals
a. Product Data describing product, installation procedures and routine maintenance.
b. Samples: 6" x 6" of tile.
c. Shop Drawings, showing fabrication details, tile surface profile, fastener locations, placement of tiles including joints and installation procedures.
d. Maintenance instructions.

A.5 Quality Assurance
a. Provide Pavers that comply with ADA walking surface requirements for detectable warnings.
b. Provide Pavers and accessories as produced by a single manufacturer with a minimum experience of 3 years.
c. Engage an experience installer certified in writing by the Paver Manufacturer, who has successfully completed installations similar in materials and design.

d. Compliance with the following ASTM Standards:
    i. Water Absorption not exceed 0.05% when tested by ASTM D 570-98.
    ii. Slip Resistance not less than 0.80 when tested by ASTM C 1028-96.
    iii. Chemical Stain Resistance to acid, urine, turpentine, chewing gum 10%; diesel fuel, motor oil 5% when tested by ASTM D 543-95.
    iv. Abrasive Wear by ASTM D 2486-00.
    v. Accelerated Weathering 3000 hour no fading or chalking by ASTM G 155-05a.
    vi. Accelerated Freeze Thaw no evidence of cracking, checking or warping by ASTM D 1037-99.
    vii. Salt Performance 200 hours exposure no deterioration by ASTM B 117-03.

A.6 Delivery, Storage and Handling

a. Suitable packaged to prevent damage in shipment or handling and delivered to the site where the pavers can be stored at minimum temperature of 40 °F for 24 hours prior to installation.

A.7 Site Conditions

a. Maintain minimum temperature of 40° F to receive pavers for 24 hours prior to, during and 24 hours after installation.
b. The use of water for work, cleaning and dust control, shall be contained and controlled. Provide barricades.

A.8 Warranty

a. Manufacturer to warrant in writing against defective work, breakage, deformation, fading and loosening of tile for a period of 10 years from the date of final completion.

A.9 Extra Stock

a. Deliver extra stock materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification. Furnish not less than 2% of the supplied materials of type, color and pattern installed.

B Materials

B.1 Basis of Design Product:

a. The design of the Detectable / Tactile Tile is based on "Armor-Tile" as manufactured by Engineered Plastic, Inc., Williamsville, NY (800) 682-2525. Subject to compliance with the requirements, an equivalent product will be given consideration.
b. Subject to compliance with the specified and detailed requirements a comparable product will be considered by:
    i. ACCO Polymer Products Inc. , Chardon, OH (440) 285-7000,
    ii. Approved equal.

B.2 Detectable / Tactile Tiles

a. Vitrified Polymer Composite (VPC) Cast-in-Place Detectable/Tactile Warning tiles shall be an epoxy polymer composition with an ultra-violet coating employing aluminum oxide particles in the truncated domes:
b. The tiles shall incorporate an ADA complying pattern of truncated domes measuring nominal 0.2" high, 0.9" base diameter and 0.45" top diameter, spaced center to center 2.35" measured on a diagonal and 1.70" side to side.
c. The field area shall consist of a non-slip surface with a minimum 40 -90° raised points 0.045" high per sq. inch.
d. Tiles shall be held within the following dimensions and tolerances:
    i. Width: 24 inches
    ii. Length : the width of the stair runs minus 3 inches on each side.
    iii. Depth of Internal Flanges and Edge Thickness : 1 3/8" (+/-) 5% max.
    iv. Face thickness in field: 0.125" at domes 0.325".
    iv. Warpage of Edge: 0.5% max.
e. Color: homogeneous throughout the tile in "Yellow" conforming to Federal Color No. 33538.

B.3 Accessories:

a. Edge Plates: 1/8" x 1" stainless steel connected in shop with stainless steel structural rivets to the front and back edges of tiles.
b. Heavy duty elastomeric polyurethane sealant as manufactured by Boiardi, Mapei, Bostik in color to match the surrounding concrete landings.

C Construction

C.1 Preparation

a. The physical characteristics of the stair landings concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast-In-Place Detectable/Tactile Warning Tile system. An overly wet mix will cause the tile to float, therefore under all conditions, suitable weights such as concrete blocks or sandbags (25 lb) shall be placed on the tile modules.
b. Prior to placement of the Cast In Place Detectable/Tactile Warning Tile system, the contract drawings shall be reviewed and a layout drawing prepared by the installation contractor to resolve the issues related to pattern repeat, tile cuts, expansion joints, control joints and stair landing surface interferences.
c. The concrete pouring and finishing operations require typical mason's tools, however, a mason's line, radius edge (1/8 x 3/16" return) tool, 4' long x 2" wide x 1/8" thick steel straight edge, 25 lb. weights, vibrator wand and small sledge hammer with 2" x 6" x 20" wood tamping plate are specific to the installation of the Cast-In-Place System.
d. The concrete shall be poured and finished level, true and smooth to the required dimensions prior to tile placement. Immediately after pouring concrete, a mason's line should be strung parallel to stair landing edge to act as a reference line for placement of tile, and then the tile assembly shall be placed true to the platform edge and to each other on the concrete.

C.2 Installation

a. The Cast-In-Place tiles shall be tamped or vibrated into the fresh concrete to ensure that the field level of tile is flush to the adjacent concrete or stair landing surface. The shop drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes. The tolerance for elevation differences between tile and adjacent surface is 1/16".
b. Immediately after tile placement, the tile elevation is to be checked to adjacent concrete or rubbing board heights with a steel straight edge. The tile elevation should be set consistent with shop drawings.
c. While concrete is workable steel edging trowel 1/8" radius x 3/16" return is to be used to edge the tile to adjacent concrete surfaces running parallel and perpendicular to the stair landing edge. While edging, ensure that a clean edge definition is created between tile and adjacent concrete and that tile to concrete elevations meet the shop drawing tolerances.
d. The placement of Cast-In-Place Tile assemblies to each other and to the mason's line or form edge shall be true and parallel to develop a true line consistent with the stair landing edge. A tight tile to tile placement can best be achieved by raking out the concrete at the butting edge to avoid trapping concrete or aggregate between tiles and/or form edge.
e. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external force placed on the tile to rock the tile, causing a void between the underside of tile and concrete.
f. Following tile placement, review installation tolerances to shop drawings and adjust tile before the concrete sets, suitable weights of 25 lb. shall be placed on each tile and additional weights at tile to tile assemblies as necessary to ensure solid contact of tile underside to concrete.
g. Following the curing of the concrete, the protective plastic wrap is to be removed from the tile face by cutting the plastic with a sharp knife tight to the concrete/tile interface. If concrete bleeding occurs between tiles, a wire brush will clean the residue without damage to the tile surface.
h. Apply the elastomeric polyurethane sealant to the tile edges as specified in Section 07 92 00 .Proper surface preparation requires that the tile and adjacent surfaces are mechanically etched with sandpaper or a carbide burr and wiped clean and dry with acetone. Applications of the polyurethane sealant shall be level to the adjacent surface and a straight line formed to the tile edge. A quality installation of the sealant requires that the tile face be masked off with duct tape to ensure a clean definition of sealant to the adjacent surfaces.

C.3 Cleaning and Protection

a. Protect tiles against damage during construction period to comply with Cast-in-Place detectable/tactile warning tile manufacturer's specification.
b. Protect Cast-in-Place detectable/tactile warning tiles against damage from construction traffic following installation by covering with plywood.

c. Clean Cast-in-Place detectable/tactile warning tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean Cast-in-Place detectable/tactile tiles by method specified by tile manufacturer.

D Measurement

The department will measure Detectable Warning Tiles as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.27	Detectable Warning Tiles	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

51. Painting, Section 09 91 00, Item SPV.0105.28.

A Description

A.1 General

The special provision described the labor and materials for the furnishing and installation, including surface preparation, priming and field painting of all structural steel, the steel roof deck underside and all steel fabrications, as well as the high abuse impact resistant gypsum wall board and cement board assemblies, the existing station precast concrete southwall, all existing and new concrete walls and ceilings in the egress tunnel and related stairs and the new concrete knee walls under the north window wall and southwall. The painting work also includes all exposed or visible metal electrical conduit and the exposed aluminum down spots contained within the steel columns flanges, plus any incidental surfaces, as shown on the architectural drawings, inferable there from and specified herein.

a. Paint exposed surfaces, except where the paint schedule indicate that a surface or material is not to be painted or is to remain natural. If the paint schedule does 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 architect will select from standard colors and finishes available.
b. Do not paint prefinished items, finished metal surfaces, operating parts, and labels.
    i. Prefinished items include light fixtures.
    ii. Finished metal surfaces include the pre-finished aluminum, stainless steel and chromium plating.
    iii. 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.

A.2 Related Work Specified Elsewhere:

a. Section 03 41 20 - Precast Concrete Patching
b. Concrete Structures
c. Precast Prestressed Slab Spans
d. Section 05 12 50 - Architectural Exposed Structural Steel
e. Section 05 30 00 - Metal Roof Deck
f. Section 05 50 00 - Metal Fabrications
g. Section 05 72 00 - Aluminum Down Spouts
h. Section 09 21 00 - Gypsum Board Assemblies
i. Section 26 05 29 - Electrical Hangers and Supports
j. Section 26 05 33 - Raceways and Boxes

A.3 Definitions

General: Standard coating terms defined in ASTM D 16 apply to this section.

a. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
b. Satin or Pearl refers to low luster finish with a gloss range between 15 and 30 when measured at a 60 degree meter
c. Eggshell refers to a very low luster finish with a gloss range between 8 and 55 when measured at a 60 degree meter.
d. Flat refers to a lusterless or matte finish with a gloss range below 8 when measured at an 85 degree meter

A.4 Submittals:

a. Product Data: For each paint system specified. Include primers.
b. Samples for Selected Manufacturer's actual colors painted on phenolic paper for each type of finish-coat material indicated.
c. Mockups: Full-coat finish sample (benchmark sample) of coating, substrate, color, and finish required in area of not less than 100 sq. ft. for ceiling and wall finishes on gypsum board, cement board and structural steel frame finish.

A.5 Quality Assurance

a. Comply with the applicable portions of the standard spec 517 Paint and Painting.
b. 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.
c. Source Limitations: Obtain primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

A.6 Delivery, Storage and Handling

a. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
    i. Product name or title of material.
    ii. Product description (generic classification or binder type).
    iii. Manufacturer's stock number and date of manufacture.

iv. Contents by volume, for pigment and vehicle constituents.
v. Thinning instructions.
vi. Application instructions.
vii. Color name and number.
viii. VOC content.

b. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
c. 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.

A.7 Project Conditions

a. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
b. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg

B. Materials

B.1 Manufacturers

a. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.
b. 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:
    i. Benjamin Moore and Co. (Moore)
    ii. Sherwin Wiliams (SW)
    iii. Tnemec Company (Tnemec)
    iv. Pittsburgh Paints (PP)

B.2 Paint Materials

a. Material Compatibility: Provide, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
b. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
c. 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 the other manufacturers listed above. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

d. VOC Content of Field Applied Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorant added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24). These requirements do not apply to paints and coatings applied in a fabrication or finishing shop.
    i. Flat Paints, Coatings and Primers: VOC content of not more than 50g/L.
    ii. Non-Flat Paints, coatings and Primers: VOC content of not more than 150 g/L.
    iii. Anti-Corrosive and Anti-Rust Paints applied to Ferrous Metals: VOC content of not more than 250g/L.
e. Colors and Sheens: Architect to select colors and sheens by reference to manufacturer's color designations. Colors may require minor modification and/or adjustment as determined by the architect. Colors will be selected for:
    i. Structural Steel and Metal Fabrications.
    ii. Gypsum and Cement wallboard walls and ceilings.
    iii. Precast Concrete and Cast-in Place Concrete.
    iv. Visible Electrical Conduit.
    v. Visible Aluminum Downspouts.

C Construction

C.1 Examination

a. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
b. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
c. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
d. 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.
    i. Notify the architect about anticipated problems using the materials specified over substrates primed by others.

C.2 Preparation

a. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
    i. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
b. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning and wash with Tri-Sodium Phosphate.

c. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
d. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified. Sand previously painted surfaces to break the surface and rewash with TSP.
e. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
    i. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
    ii. 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.
    iii. Use only thinners approved by paint manufacturer and only within recommended limits.
    iv. 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.

C.3 Application

a. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
b. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
c. 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.
d. Omit primer on metal surfaces that have been shop primed and touchup painted.
e. 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.
f. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C.4 Application Procedures:

Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

a. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
b. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
c. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

C.5 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.

C.6 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.

C.7 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.

C.8 Completed Work:
Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

C.9 Field Quality Control
a. The owner reserve the right to engage the services of an independent testing agency to sample paint material being used and finished paint thickness, and may direct the contractor to stop painting if test results show material being used does not comply with specified requirements.
b. The contractor shall remove non-complying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

C.10 Cleaning
a. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
b. 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.

C.11 Protection

a. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by architect.
b. Provide “Wet Paint” signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
c. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

C.12 Paint Schedule

This paint schedule generally makes reference to one manufacturer’s proprietary product names, but is not intended to imply that the products named are required to be used to the exclusion of equivalent products of the other manufacturers listed in this specification.

C.12.1 Gypsum Board and Cement Board Assemblies

Satin Acrylic Emulsion Finish: 2 finish coat over primer

a. Gypsum Board Primer; Tnemec Series 180 "W.B. Tnemec-Crete"at a spreading rate to achieve a dry film thickness of not less than 4.0 mils.
b. Intermediate Coat: Tnemec Series 180 W.B. Tnemec-Crete " at a spreading rate to achieve a dry film thickness of not less than 4.0 mils.
c. Finish Coat: Tnemec Series 156 "Enviro-Crete" at a spreading rate to achieve a dry film thickness of not less than 4.0 mils.

C.12.2 Existing Precast Concrete Walls and Existing and New Cast-in Place Concrete Walls and Ceilings

Satin Modified Waterbourne Acrylic: 2 finish coats over primer

a. Concrete Primer: Tnemec Series 180 "W.B. Tnemec-Crete"at a spreading rate to achieve a dry film thickness of not less than 4.0 mils.
b. Intermediate Coat: Tnemec Series 180 "W.B. Tnemec-Crete " at a spreading rate to achieve a dry film thickness of not less than 4.0 mils.
c. Finish Coat: Tnemec Series 156 "Enviro-Crete" at a spreading rate to achieve a dry film thickness of not less than 4.0 mils.

C.12.3 Ferrous Metal, Architectural Structural Steel, Steel Roof Deck, Metal Fabrications, Electrical Conduits and Aluminum Downspouts.

Satin Aliphatic Thermoset Solution Fluoropolymer Finish: One finish coat over an enamel undercoat and a primer.

a. Primer: Rust-inhibitive, steel and galvanized metal primer, Tnemec.
b. Series 66 "Hi-Build Epoxoline" at aspreading rate to achieve a dry film thickness of not less than 3.0 mils.
c. Undercoat: Tnemec Series 27 "Typoxy" at a spreading rate to achieve a dry film thickness of not less than 3.0 mils.

d. Finish Coat: Tnemec, Aliphatic Acrylic Polyurethane Enamel: Series 73" Endura-Shield" at a spreading rate to achieve a dry film thickness of not less than 3.0 mils

D Measurement

The department will measure Painting as a single lump sum unit of work, acceptably completed.

E. Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.28	Painting	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

52. Louvers and Vents, Section 10 20 00, Item SPV.0105.29.

A Description

A.1 General

This special provision describes the labor and materials for the fabrication, furnishing and installation of fixed and drainable aluminum louvers as inserts into the related extruded aluminum frames (supplied under Section 08 41 00 Aluminum Window Wall) and all required accessories and hardware as shown on the architectural drawings, inferable there from and specified herein.

The work specified in this section includes:

a. The louver window wall infills over exit doors at the northeast and northwest corners of the shed.
b. The louvers over the access doors to the Elevator Machine Rooms under the escalators on the north, middle and south platforms.
c. The louver window wall infills between the roof gutter and the north window wall or gasket skylight.
d. The louver window wall infills between the roof gutter and the south corrugated panel closure wall.

A.2 Standards

a. Comply with Standard Specifications for Aluminum and Aluminum Alloy sheet, plate and extruded bars, rods, tubes –ASTM B 209 and ASTM B 221 and the performance requirements, demonstrated by testing according to AMCA 500-L.
b. Coordinate louver installation with Composite Metal Panels specified under 07 41 00, Aluminum Window Wall specified under 08 41 00, the Roof Guardrails specified under Metal Fabrications 05 50 00 and Electrical Hangers and Supports 26 05 29.

A.3 Quality Control

a. Subcontract the aluminum louver system to a firm, who has specialized for a period of not less than 5 years in the fabrication and installation of aluminum louvers.
b. Manufacturer's Warranty of 10 years.

A.4 Delivery Storage and Handling

a. Deliver louvers and installation accessories completely identified for field installation.
b. Store in accordance to manufacturer's instructions, above grade, on dunnage properly protected from weather and construction activity.

A.5 Submittals

a. Contractor shall submit product data and shop drawings, showing the construction of all parts of the work, including metal thickness, methods of joining, details of field connections and anchorage, fastenings and sealing methods and metal finishes.
b. Relationship to other work should be clearly indicated. No work shall proceed until shop drawings have been reviewed and accepted by the architect.
c. Contractor shall submit finish samples of frame (when applicable) and blade sections, with visible fasteners and warranties.

B Materials

B.1 Aluminum

a. Extruded Aluminum: ASTM B 221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.
b. Sheet Aluminum: ASTM B 209, 5005 alloy, H15 or H34 temper.

B.2 Reinforcing Steel

a. Reinforcing Steel ASTM A 924/A 924 M galvanized to minimum G90. and ASTM A 36/A3 6M galvanized.

B.3 Fasteners

a. Fasteners of the same material and alloy as fastened metal or 300 Series stainless steel.

B.4 Louver Inserts

a. Horizontal Extruded Aluminum, Stationary, Storm Blade, Drainable Louvers.
b. Aluminum thickness: 0.081 "for blades and 0.125" for frames, louver depth 4", louver slope not less than 35 ° to be inserted in frame within window wall framing.
c. Free Area: not less than 54% with beginning point of water penetration @ 1,250 fpm and an air volume flow rate @ 10,700 cfm.
d. Louvers over access doors to Elevator Machine Rooms to receive insect screening over 3/4" square mesh bird screening.

B.5 Frames

a. Vertical Frames shall be 2” face by 6” deep; Horizontal Frames shall be 4" face by 6" deep.

B.6 Finish

a. Comply with NAAMMs "Metal Finishes Manual for Architectural Metal Products. Fluoropolymer Coating 70% PVDF conforming to AAMA 605-02-92 in a white color selected by the architect.
b. Louver finish over Elevator Machine Room Doors shall match the "blue" color of the surrounding Composite Metal Panels.

C Construction

C.1 Fabrication

a. All notching and welding to be done prior to application of the material final finish to ensure complete seal and coating of all surfaces.
b. All exposed surfaces to be fine satin finish prior to application of material finish to eliminate extrusion die marks and fabrication marks.

C.1.1 Painted Finish

a. Chemically cleaned for organic coating of fluoropolymer system with minimum 70 percent polyvinylidene fluoride 2 coat resin meeting the performance requirements of AAMA 2605 and be oven baked @ 450° in colors to be selected by the architect as noted above.

C.2 Installation

a. Perform cutting, drilling and fitting required, setting accurately in location, alignment and elevation with edges and surfaces level, plumb, true and free of rack.
b. Using concealed anchors where possible, anchor securely using built-in anchor bolts or expansion bolts designed for the intended use and loads.
c. Protect louvers from galvanic action by applying a heavy coat of bituminous paint on surfaces in contact with concrete, masonry or dissimilar materials.
d. Protect paint finish from damage during construction with temporary protective coverings and restore any finish that may have been damaged, leaving no evidence of repair and ready to receive finish coats of paint.

D Measurement

The department will measure Louvers and Vents as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.29	Louvers and Vents	LS

PPayment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

53. Signage, Section 10 43 00, Item SPV.0105.30.

A Description

A.1 General

This special provision describes the fabrication, furnishing and installation of the all the signage in the shed which includes:

a. The Platform Signage Panels containing Back-Lighted Advertising Signs, the Programmable LED Message Displays, the Paging Loudspeaker Horns, the Platform Emergency Lighting, the Exit Signs, the Elevator Directional Signs and the Fire Alarm Audio/Visual Fixtures to be inserted into the steel frames specified under Metal Fabrications in Section 05 50 00.
b. The post mounted parallel platform Station Identifier panels along the south wall of the shed and extending east and west along the length of Platform 3.
c. Station Identifier text of flat cut acrylic letters embedded into the concrete floor of Platforms 1, 2 and 3.
d. The cast zinc Special Instruction signs that provide tactile copy and braille text to inform sight impaired travelers and all the required accessories and hardware for mounting on tempered glass guard rails, metal panels and concrete walls as shown on the architectural drawings, inferable there from and specified herein.
e. The signs for the Hearing Loop Systems located on the elevator door jambs on the platform and mezzanine levels and on the tunnel east wall.

A.2 Standards

a. Comply with standard specifications for exposed metal surfaces established by the National Association of Metal Manufacturers (NAAMM) "Metal Finishes Manual".

A.3 Related Work Specified Elsewhere

a. Concrete Structures
b. Section 05 50 00: Metal Fabrications
c. Section 26 05 33 : Raceways and Boxes
d. Section 26 27 26: Wiring Devices
e. Section 26 51 00: Luminaires
f. Section 27 51 00: Public Address System
g. Section 28 31 00: Fire Detection and Alarm

A.4 Coordination

a. Coordinate platform signage, LED Message Displays, Loudspeakers, Emergency Lighting, Exit Signs, Elevator Direction Signs and Audio/Visual Alarms installation with steel frames specified under Metal Fabrications in Section 05 50 00 and the electrical power, emergency power, voice and data connections required by each sign panel.

b. Coordinate the installation of platform embedded station identifiers with the placement, floating and troweling and striating of concrete.

A.5 Quality Assurance

a. Fabricator/Installer shall be an experienced specialty firm, regularly engaged for not less than 5 years in the fabrication and installation of work similar to the type required herein, employing skilled personnel and with complete facilities to produce the work.
b. Manufacturer's Warranty of 5 years

A. 6 Submittals

a. Shop Drawings showing signage panel fabrication and installation details, including anchorage and relationship to other work.
b. Product data of all components.
c. Samples of finish.
d. Platform Embedded Sign Mockup.
    i. Prior to proceeding with the fabrication, provide an embedded sign installed in concrete within a plywood box form for review and acceptance by the architect.

A.6 Delivery, Storage and Handling

a. Deliver fabricated platform sign panels to project site, completely assembled and prepared for installation and connections to power, voice and data service in hand holes that surround the foundation.
b. Deliver platform floor epoxy polymer station identifier signs with an installation template or a backing system and ready for embedment into concrete.

B Materials

B.1 Platform Sign Panels

B.1.1 Back-Lighted Signs (facing each side)

a. Steel Plates, Shapes and Bars: ASTM A 36/A 36 M galvanized to a minimum G 90.
b. Extruded Aluminum: ASTM B 221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.
c. Fasteners and Hardware of the same material and alloy as fastened metal or 300 Series stainless steel.
d. Translucent acrylic, ¼" thick light diffusing panels.
e. Tempered glass, ¼" thick plate or float glass, Type 1 Class, quality Q3 with graduated silk screened dot pattern border to cover steel angle frame.
f. High performance fluorescent fixtures with instant start, cold weather.
g. (-10° F) electronic ballasts and 4'-0" T8 lamps.
h. Electrical Components, Conduit, Wiring, Devices and Accessories: Listed and labeled as defined in NFPA 70.
i. Sealants: For joints at perimeters as specified in Section 07 92 00.

j. Paint Finish: Satin Aliphatic Thermoset Solution Fluoropolymer system finish as specified in Section 09 91 00 for ferrous metals in a "white" color selected by the architect.

B.1.2 Programmable L.E.D. Message Displays (facing each side)

a. Prefabricated, multiple four (4) line information panels 12" high by 48" wide, 5 1/4" deep for flush installation into the Platform Frames. The matrix is 36 x 160 green monochrome LED's on 0.3" (8mm) o.c spacing.
b. The L.E.D. Message Display shall be able to withstand and operate at temperature extremes of -40°F to + 120°F, outdoor damp location rated.
c. Message System shall be capable of displaying multiple lines of text with multiple characters per line, 2" high minimum font, programmable and changeable, wireless controlled with ethernet communication from a location within the Station using a computer with an L.E.D. Sign Message software.
d. The L.E.D.'s shall be visible in bright daylight and have a minimum projected life of 50,000 hours.
e. Information panel faces shall provide a high contrast background fabricated from aluminum sheet over a polycarbonate layer protecting the L.E.D. pixel display matrix from weather infiltration to match back-light sign finish.

B.1.3 Built-in Loudspeakers.

a. Weatherproof assembly with double re-entrant horn, compression type driver, integral 25 V and 70.7 V universal transformer and adjustable mounting flange. Diameter 8 7/8"; Depth 9 3/16" equivalent to paging horn QH16T by Quam-Nichols Co. Chicago, IL (800) 633-3669 as the basis for design.
b. On Island platforms Nos. 2 and 3 the center post mounted sign panels shall have two loudspeakers, mounted on each side of the L.E.D. panel, with one speaker facing East and West.
c. On Platform No. 1 against the Station, the column mounted sign panels shall have one loudspeaker, mounted facing down, between the emergency lighting fixtures and the exit signs.
d. Audio Specifications:
    i. Average Sensitivity: 110 dB SPL, 1W/1M
    ii. Power Rating: 16W-RMS, EIA 426A Standard
    iii. Maximum System Output: 121 dB-SPL 16W/1M
    iv. Frequency Response: 300 - 15kHZ
    v. Transformer Tap Selection: Selector switch
    vi. Audio Connection: Binding screw

B.1.4 . Built-in Exit and Elevator Direction Signs (on one or two sides of panel)

a. Heavy duty vandal resistant single face Exit Signs and/or custom Elevator Direction Sign for recessing into the Platform Sign Panels, consisting of die cast aluminum body and stencil face plate and case, tamper resistant access , high output L.E.D. "green" lamps designed for wet locations.

b. Exit Face of 6” high and ¾” stroke green letters with directional arrows as required to indicate “left” or “right” or custom directional graphics. Finish: epoxy based powder coat in a "white" color coordinated with sign panel finish and selected by the architect. Refer to Architectural drawings for Elevator Direction Sign graphics.
c. Exit and directional sign shall be equivalent to “Signature” Series, recessed, single face 12 15/16" wide x 9 7/16" high x 4" deep as manufactured by LITHONIA LIGHTING, Conyers, GA – (770) 922-9000 as the basis for design.
d. Power Input: 120/277 VAC, 60 HZ, with central system emergency back-up battery.

B.1.5 Platform Emergency Lighting.

a. Surface mounted, linear forward throw, optic fluorescent fixture with remote electronic ballast, 24 " long with one T8 lamp (4 fixtures per panel) equivalent to Type F 301 as manufactured by Elliptipar, West Haven CT (203) 931-4455 as the basis for design.
b. Power Input: 120/277 on central system emergency back-up battery.
c. White translucent plastic diffuser panel under each fixture on the bottom access doors of the sign panels.

B.1.6 Audio / Visual Alarms.

a. Refer to Specification Section 26 72 30. To be supplied by electrical contractor.

B.1.7 Applied Text: Station Identifier

a. Copy: Waterject cut 1/8” thick aluminum letters and symbols for stem mounting to steel sign panel substrate.
b. Letters and symbols shall be Helvetica Medium to be painted with acrylic polyurethane with UV inhibitors, eggshell finish (11-19) degree gloss in blue color to match the Composite Metal Panels to be selected by the architect.

B.2 Parallel Platform Station Identifier Sign Panels

B.2.1 Frame

a. Extruded 2” x 2” x 1/8” wall aluminum posts attached to the ends of the sign panels and painted with acrylic polyurethane with UV inhibitors, eggshell finish (11-19) degree gloss in white color, embedded directly into 6” f x 36” deep concrete filled cylinder forms.

B.2.2 Panels

a. 12” x 72” x 2” thick panels constructed of vandal, scratch, fade and weather resistant materials, with a panel core to prevent warping, mounted @ 30” and 90” to the center line above the platform level, attached to the sides of sign posts. Panels shall be painted with acrylic polyurethane with UV inhibitors, eggshell finish (11-19) degree gloss in a white color.

B.2.3 Copy

a. Exterior grade vinyl die-cut letters applied to the second surface of a 1/8" non-glare polycarbonate face panel. Helvetica Medium 6" high capital letters text in a blue color to match the Composite Metal Panels to be selected by the architect.

B.3 Platform Embedded Flat Cut Acrylic Station Identifier Signs

B3.1 Letters

a. Laser flat cut 3/8" thick x 6" high pigmented acrylic Helvetica Medium letters with a smooth finish for embedment into wet concrete after platform floors are trowelled. Capital letters shall be in a blue finish to match the Composite Metal Panels to be selected by the architect.

B.3.2 Embedment Studs

a. Integral flush ¼" diameter stainless steel threaded stud extensions with stainless steel nuts drilled and tapped into the 3/8" acrylic at a minimum of two locations on the verticals or diagonals backs of the letters.

B.3.3 Installation Template

a. Reverse reading Placement Template that facilitates the consistent installation of uniformly spaced and properly aligned text by holding the letters, enabling the application of pressure to embed the text flush with the concrete platform surface and the subsequent removal of the template without distortion or movement in the letters.

B.4 Cast Metal Special Instruction Signs

a. Vandal resistant zinc alloy, scratch and fade resistant 1/8" thick plate.
b. Sign panel 4.5" H x 9" W in eggshell acrylic polyurethane finish (11-19 degrees gloss) to match color to be selected by the architect.
c. Tactile copy in 5/8" cap height Helvetica Bold, as shown and scheduled on the drawings, open letter spacing (+10%of URW), 1/8" border and Grade Two Braille raised 1/32" by metal etched process. Copy and border color: White.
d. Refer to drawings for copy, justification and spacing between text lines.

B.5 Hearing Loop Systems Signs

B.5.1. Sign Panels (Labeled 14.0)

a. 6" wide x 7" high x 1/8" panels constructed of plate aluminum to be mounted above the Elevator Signal on the re-entrant Elevator Door Jambs as shown on 5/A 415 and on the East Tunnel wall.

B.5.2 Finish

a. Sign panels to be painted with acrylic polyurethane with UV inhibitor in eggshell finish (11-19) degree gloss in white color to be selected by the architect.

B.5.3 Copy

a. Exterior grade vinyl die-cut image and text as detailed in Drawing 6/A705 in a blue color to match the project Composite Metal Panels to be selected by the architect.

C Construction

C.1 Fabrication

C.1.1 Fabrication Platform Sign Panels

a. All notching, casting, etching and welding to be done prior to application of the material final finish to ensure complete seal and coating of all surfaces.
b. All exposed surfaces to be fine satin finish prior to application of material finish to eliminate extrusion die marks and fabrication marks.
c. Factory install all required electrical components, conduits and fixtures within the panels and within the platform panel columns so that all connections can are made to hand hole units surrounding the panel columns or from the surface mounted conduit on the columns supporting the cantilevered panels.
d. Painted Finish: Chemically cleaned for organic coatings for specified finish.
e. No paint that will fade, discolor or delaminate as a result of ultra violet light or heat will be used. Prime coats or other surface pre-treatments, shall be included in the work. All paints shall be evenly applied without pinholes, scratches, orange peeling or imperfections.

C.1.2 Fabrication Parallel Platform Station Identifier Sign Panels

a. All cutting and fabricating shall be executed in such a manner that all edges, corners are true and clean.
b. Provide the letters and apply them neatly, uniformly proportioned and spaced and accurate within the dimensions indicated in the contract drawings.
c. No paint that will fade, discolor or delaminate as a result of ultra violet light or heat will be used. Prime coats or other surface pre-treatments, shall be included in the work. All paints shall be evenly applied without pinholes, scratches, orange peeling or imperfections.

C.1.3 Fabrication of Platform Embedded Station Identifier Signs

a. All cutting and fabricating shall be executed in such a manner that all edges, corners are true and clean.
b. Fabricate letters with the appropriate studs on the backs to provide the necessary anchorage in the concrete substrate.
c. Provide the letters and apply them neatly, uniformly proportioned and spaced and accurate within the dimensions indicated in the contract drawings with the aid of an installation template.

C.1.4 Fabrication Cast Special Instruction Signs

a. All cutting and fabricating shall be executed in such a manner that all edges, corners are true and clean.

b. Letter forms must be sharp, free of rounded positive or negative corners, edge build-up bleeding, etc. Letterforms must be aligned and maintain a base line parallel to the sign format.
c. No paint that will fade, discolor or delaminate as a result of ultra violet light or heat will be used. Prime coats or other surface pre-treatments, shall be included in the work. All paints shall be evenly applied without pinholes, scratches, orange peeling or imperfections.

C.2 Installation

C.2.1 Platform Sign Panels and Parallel Platform Station Identifier Panels

a. Locate signs where indicated or directed by architect. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
b. Coordinate with the work of other trades so as to prevent damage or interference.
c. Perform any field cutting, drilling and fitting required , setting accurately in location, alignment and elevation with edges and surfaces level, plumb, true and free of rack.
d. Perform all electrical and communications connections and test all lighting fixtures and emergency power operation.
e. Protect paint finish from damage during construction with temporary protective coverings and restore any finish that may have been damaged, leaving no evidence of repair.

C.2.2 Installation of Platform Embedded Station Identifier Signs

a. The physical characteristics of the platform concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the embedded signage system.
b. The concrete pouring and finishing operations require typical mason's tools, however, a mason's line, radius edge (1/8 x 3/16" return) tool, 4' long x 2" wide x 1/8" thick steel straight edge, vibrator wand and small sledge hammer with 2" x 8" x 72" wood tamping plate are specific to the installation of the embedded signage system..
c. The concrete shall be poured and finished level, true and smooth to the required dimensions prior to signage placement. Immediately after pouring concrete, a mason's line should be strung parallel to platform edge to act as a reference line for placement and then the sign assembly shall be placed true to the platform edge and to each other on the concrete.
d. The cast-in-place letters retained by the installation templete shall be tamped or vibrated into the fresh concrete to ensure that the field level of the letters is flush to the adjacent concrete
e. While concrete is workable ensure that a clean edge definition is created between letters and adjacent concrete.
f. During and after the sign installation and the concrete curing stage, it is imperative that there is no walking or external force placed on the letters.
g. If concrete bleeding occurs between letters, a fiber brush will clean the residue without damage to their surface.

C.2.3 Installation of Cast Special Instruction Signs

a. Locate signs where indicated on the contract drawings. Install signs level, plumb and at the height indicated.
b. Corner, tamper proof screws, anchor securely using expansion bolts designed for the intended use and loads.
c. On adhesive installations use materials in accordance to the manufacturer's recommendations. Adhesives shall be non-staining, non-yellowing, free of air bubbles and defects.
d. Mount 60 " to center line of walls and 40" to center line of railings with adhesives or tamper proof screws and expansion shields on pre-drilled corner holes suitable to the substrate.

C.2.4 Installation of Hearing Loop System Signs

a. Locate signs where indicated on the Contract drawings. Install signs level, plumb and at the height indicated above the Elevator Signal or @ 80" to the center line above the Tunnel floor.
a. Corner, tamper proof screws, anchor securely using expansion bolts designed for the intended use and loads.
b. On adhesive installations use materials in accordance to the manufacturer's recommendations.

C.3 Cleaning and Protection

a. Protect all signs against damage during construction period.
b. Protect cast-in place signage against damage from construction traffic following installation by covering with plywood. Do not remove adhesive paper cover until substantial completion.
c. Clean all signage not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project.
d. Clean the exposed surfaces of the work to remove dirt, stains and other soiling by methods recommended by the manufacturers. Touch up minor blemishes or marring. Replace components having permanent scratches or stains.

D Measurement

The department will measure Signage as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.30	Signage	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

54. Holeless Hydraulic Elevators, Section 14 20 00, Item SPV.0105.31.

A Description

A.1 General

This Special Provision describes the fabrication, furnishing and installation of 3 Holeless Hydraulic Dual Jack Front Opening Elevator systems, including the elevator cabs, the elevator entrances linking the Platforms to the Mezzanine and designed expressly for passenger traffic-loading conditions in an untempered environment. The work requires the maintenance of the completed installation for a period of 12 months after acceptance by ownership and must be specifically designed to suit rise heights and shaft enclosure as shown on the architectural drawings, inferable there from and specified herein.

All work will be performed in a workmanlike manner and in all cases where a device or part of equipment is herein referred to in a the singular number, it is intended that such reference will apply to as many such devices as are required to complete the installation.

A.2 Elevator Equipment Holeless Dual Jack Hydraulic

a. Openings: Front
b. Landings: 2
c. Travel: 26'-0" on Platforms No. 1 and No. 2 and 25'-5" on Platform No. 3
d. Rated Capacity: 2,500 lbs.
e. Rate Speed: 100 fpm
f. Cab Clear Inside Dimensions: 60" W x 60" D
g. Clear Ceiling Height: 8'-0"
h. Entrance Width: 3'-0" Center Opening- Height 7'-0"
i. Main Power Supply: 208 V +/- 5% - 3 phase
j. Operation: for each elevator: Two–stop Simplex "automatic operation" as defined by ASME A17.1
k. Machine and Control Space: Platform Level Under Adjacent Escalators
l. Elevator pit ladder and hoistway beam.

A.3 Standards

The elevator work shall comply with the following:

a. ANSI/ASME A17.1-2004, Elevators and Escalators
b. ANSI/NFPA 70, National Electrical Code.
c. ADA, Americans with Disabilities Act.
d. State Building Codes as may be applicable.

A.4 Work Not Included:

The following items must be performed or furnished by other than the elevator contractor:

a. A properly framed and enclosed legal hoistway, including venting.
b. A suitable machine room with legal access, heating and ventilation and a concrete floor. Temperature in the machine room to be maintained between 60° F and 80° F.
c. Adequate rail bracket supports and bracket spacing as required.

d. Dry pit reinforced to sustain normal vertical forces from cylinders and rails, and impact loads from buffer engagement and safety setting forces through rails. Waterproof lower well space and pit drainage as required.
e. Adequate support for sill angles across full width of the hoistway at each landing. Vertical surfaces of entrance sill supports to be plumb, one above the other, and square with the hoistway.
f. Hoistway walls constructed in accordance to the required two hour fire rating of hoistway entrance assemblies.
g. Any cutting on hoistway finished walls required to accommodate hall signal fixtures.
h. All electric power for lights, tools, hoists, etc. during erection as well as electric current for starting, testing and adjusting the elevators. Main Power Supply: 208 V +/- 5% - 3 phase.
i. A fused disconnect switch for each elevator in compliance with the National Electric Code with feeder or branch wiring to controller and size to suit the installation.
j. A 120 volt AC, 20 amp, single phase power supply with fused SPST disconnect switch for each elevator, with feeder wiring to each controller for car lights.
k. Suitable light and convenience outlets in machine rooms with light switches located within 18 inches of the machine room door active door jamb.
l. A convenience outlet and light fixture in the pit with the switch located adjacent to a pit access ladder.
m. Means within the elevator cars for communicating or signalling to an accessible point outside the hoistway or central exchange system.
n. Guarding and protecting the hoistway during construction a minimum of 48 inches high.

A4. Quality Assurance

Manufacturer shall have a minimum of ten years of satisfactory experience in the fabrication and installation of elevators equivalent to those specified and submit list of five installations of similar application.

a. Location of nearest parts warehouse.
b. Names and qualifications of five people who would normally service such equipment.
c. A list of five service customers whose similar equipment has been maintained for a period of five years and names of contacts and phone numbers.
d. Installer Qualifications: Elevator manufacturer or an experience installer approved by the elevator manufacturer who has completed installations similar in design, material and extent to that indicated for this project.

A5. Guarantee

Provide a 5 year Manufacturer's Warranty from the date of substantial completion with a maintenance and call-back service of 12 months on each elevator including periodic equipment examinations, adjustments, lubrication, cleaning, supplies and parts to ensure proper operation. All work will be performed by skilled employees during regular working days and will include emergency 24 hour callback service. Only genuine parts

and supplies as used in the manufacture and installation of the original equipment will be provided. Response time: One hour or less.

A.6 Submittals

a. Product Data: Include capacities, sizes, performances, operations, safety features, finishes and similar information.
b. Shop Drawings: Show plans, elevations, sections and large scale details indicating service at each landing, machine room layout, coordination with building structure, relationship with other construction and locations of equipment and signals. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average poser demands.
c. Samples: For exposed finishes of cars, car doors, hoistway doors and frames and signal equipment: 3 inch square samples of sheet materials. Painted finishes will be selected by the architect from custom colors.
d. Manufacturer's Certificates: Signed by elevator manufacturer certifying that hoistways, pits and machine room layouts and dimensions as shown on the Drawings, and electrical service as shown and specified are adequate for the elevator systems being provided.
e. Maintenance Manuals: Operation and maintenance instructions, part listing with sources indicated, recommended parts inventory listing, emergency instructions and similar information.
f. Inspection and Acceptance Certificated and Operating Permits as required by authorities having jurisdiction for normal unrestricted elevator use.

A.7 Delivery, Storage and Handling

a. Store materials. components and equipment in manufacturer's original protective packaging in a dry protected area. Handle materials in accordance to manufacturer's recommendations to prevent soilage, damage or deterioration.

A.8 Coordination

a. Coordinate the installation of sleeves, block outs, and items that are embedded in concrete in concrete or attached to steel framing. Furnish templates and installation instructions and deliver to the project site in time for installation.
b. Coordinate locations and dimensions for other work relating to hydraulic elevators, including the pit ladders, sumps, and pits; the entrance subsills; and the electrical service, outlets, lights and switches in pits and machine rooms.

B Materials

B.1 Basis of Design Product

a. The design for the hydraulic elevators is based on a ThyssenKrupp holeless hydraulic dual jack telescoping system. Subject to compliance with the specified and detailed requirements a comparable product will be considered by:
b. Montgomery KONE Inc.
c. Otis Elevator Company.

d. Schindler Elevator Corp.
e. Elevator Bidders are herein reminded to refer to the Notice to Contractors in the General Conditions requiring the Buy America provisions of the contract.

B.2 Hydraulic System

a. Provide manufacturer's standard elevator systems with exception of the Cab clear inside dimensions and center opening entrance width. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard pre-engineered elevator systems and as required for a complete system.

B.3 Pump Units

a. Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
b. Pump, with fan-cooled squirrel-cage induction motor, mounted under oil tank with vibration isolation mounts. Enclose pump and motor in prime-painted steel enclosure lined with 1-inchthick, glass-fiber insulation board.
c. Provide motor solid-state starting. and variable-voltage variable-frequency motor control.

B.4 Hydraulic Silencers

a. Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.

B.5 Piping

a. Provide size, type and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.

B.5.1 Casing for Underground Piping

a. PVC pipe complying with ASTM D 1785 joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.
b. Dielectric couplings at plunger between power unit and cylinder units.

B.6 Hydraulic Oil

a. Provide hydraulic oil of proper grade in the quantity recommended by manufacturer.

B.7 Inserts

a. Furnish required concrete and inserts and similar steel anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another specification section.

B.8 Elevator Cabs

a. Car Frame and Platform: Formed or structural steel members, bolted or welded together steel units.

b. Finish Materials: Provide the following materials and finishes for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated:
    i. Satin Stainless Steel Ceilings: ASTM A 6666 Type 304 with non-directional finish
    ii. Textured Stainless Steel Walls: ASTM A 666, Type 304; with embossed texture rolled into exposed surface. Surface is satin relieved after rolling. Rolled Stainless Steel 316 L Diamond Floor Plate: ASTM A 793

B.9 Operation Systems

B.9.1 Passenger Elevators

a. Provide manufacturer's standard microprocessor operation system for each elevator as required to provide type of operation system indicated.
b. Single Elevator, Two Stops: Provide "automatic operation" as defined in ASME A17.1.

B.9.2 Standby Power Lowering

a. On activation of standby power, cars are lowered to the platform level, the doors cycled, and the car parked with doors closed. The door open button is to remain active to allow passengers to exit the car.

B.9.3 Independent Service

a. Keyswitch in car allows it to respond only to car calls. Key is removable only in deactivated position.

B.10 Security Features

a. Keyswitch Feature: Car and hall push buttons are activated and deactivated by security key switches.

B.11 Signal Equipment

a. Provide signal equipment for each elevator with hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements of acrylic or other permanent, non-yellowing translucent plastic.
b. Swing Return Car Control Stations: Provide one with key switches fully recessed in hinged return car control station with applied metal faceplates. Mount in return panel adjacent to car door.
c. Include call buttons for each landing served and other buttons, switches, and controls required for specified car operation.
d. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1.at heights complying with [the U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."] [ICC A117.1.]

B.12 Emergency Communication System

a. Provide two-way voice flush-mounted communication system without hand set that complies with ASME A17.1 and U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location. System is contained within swing panel with identification, instructions for use and battery back-up power supply.

B.13 Fire Department Communication System

a. Provide telephone jack in each car and required conductors in traveling cable for fire department communication system.

B.14 Car Position Indicator

a. Provide illuminated-signal type, digital-display type, or segmented type, located above car door or above car control station. Also provide audible signal and voice message to indicate to passengers that car is stopping at the floor served.
b. Include travel direction arrows on car door jambs.
c. Hall Push-Button Stations: Provide one hall push-button station at each landing.
d. Provide units with flat faceplate for mounting with body of unit recessed in wall.
e. Hall Lanterns: with illuminated single arrow at terminal landings in both entrance frame door jambs 72" a.f.f.

B.15 Door Reopening Devices

a. Door Edge Device: Provide retractable edge shoes on elevator entrance doors that cause doors to stop and reopen upon contacting an obstruction. Include photoelectric device with timed cutout that projects dual-light beams across car entrance at 5- and 29-inch heights; the beams, when interrupted, cause doors to stop and reopen.
b. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound. When the doors are released, the doors shall begin to close at reduced kinetic energy.

B.16 Passenger Elevator Car Enclosures

a. Provide manufacturer's custom steel-framed car enclosures with non-removable wall panels, rear wall glass panel, suspended ceiling, trim, accessories, access doors, doors, power door operators, sills (thresholds), lighting, and ventilation.
b. Floor finish shall be Diamond Plate 316 L stainless steel.
c. Metal Wall Panels: Flush hollow-metal construction, fabricated from textured stainless steel side and rear panels and ¼" tempered, fire rated clear glass rear wall panel window. Satin stainless steel control panel and ceiling.
d. Fabricate car with recesses and cutouts for signal equipment.
e. Stile and Rail Glazed Stainless-Steel Doors: Glazed hollow-metal, satin stainless-steel doors. Fire rated clear glass to comply with ANSI Z97.1 and CPSC 16 CFR1 207 (Cat I and II) and tested by ASTM E 207 4 –00.

f. Sills: Extruded nickel silver, with groove(s) in top surface, 1/4 inch thick, satin finish.
g. Satin Stainless Steel Ceiling: Flush panels, with low-voltage recessed downlights in the center of each panel as shown on the drawings.
h. Handrails: 1 ½" diameter satin stainless steel standard handrails.

B.17. Passenger Hoistway Entrances

a. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories.
b. Where cold rolled steel and gypsum board wall construction clad with metal panels is indicated, provide self-supporting frames with reinforced head sections.
c. Materials and Fabrication:
    i. Enameled-Steel Frames: Formed steel sheet. Custom color to be selected by the architect.
    ii. Stile and Rail Glazed Enameled Steel Doors and Flush Transoms: Glazed hollow-metal, steel doors. Fire rated clear glass to comply with ANSI Z97.1 and CPSC 16 CFR1 207 (Cat I and II) and tested by ASTM E 207 4 –00. Enameled-Steel Doors and Transoms. Custom color to be selected by the architect.
    iii. Fire rated clear glass on rear panel of hoistway opposite the entrance doors.
    iv.. Sills: Extruded nickel silver with grooves in top surface, ¼" thick.
    v.. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107.

C Construction

C.1 Examination.

a. Examine elevator areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.
b. For the record, prepare a written report, endorsed by the installer, listing any dimensional discrepancies and conditions detrimental to performance.

C2. Installation

a. Install cylinders plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor.
b. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
c. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

d. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cement fittings.
e. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
f. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and direction of travel.
g. Set sills flush with finished floor surface at landing. Fill space under sill solidly with non-shrink, nonmetallic grout.
h. Lubricate operating parts of systems as recommended by the manufacturer.

C3.Field Quality Control

a. Acceptance Testing: On completion of elevator installation and before permitting use of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies. Advise owner, architect and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.
b. Make necessary adjustments of operating devices and equipment to ensure elevator operates safely, accurately, and smoothly.
c. Instruct owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with owner on requirements for a complete elevator maintenance program.
d. Do not use elevators for any construction purposes.
e. Provide full maintenance service by skilled, competent employees of elevator Installer. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Use the same parts and supplies as used in the manufacture and installation of original equipment
f. Provide protective coverings, barriers, devices, signs and other procedures to protect the elevators. If despite such protection, the elevators are damaged, engage the elevator installer to restore damaged work so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop or provide new units as required.

D Measurement

The department will measure Holeless Hydraulic Elevators as a single lump sum unit pf work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

55. Heavy Duty Escalators, Section 14 30 00, Item SPV.0105.32.

A Description

A.1 General

This special provision describes the fabrication, furnishing and installation of four (one side-by side pair and two single) heavy-duty outdoor glass balustrade escalator systems, linking the Platforms to the Mezzanine and designed expressly for traffic-loading conditions that are heavier than that of standard commercial duty requirements. The model of escalator provided must be specifically designed to suit rise heights of up to 65 feet as shown on the architectural drawings, inferable there from and specified herein.

A.2 Standards

The Escalator work shall comply with the following:

a. ANSI/ASME A17.1-2004, Elevators and Escalators
b. ANSI/NFPA 70, National Electrical Code.
c. ADA, Americans with Disabilities Act.
d. Latest editions of governing codes and ordinances at the time of bid.
e. Provision of licences, permits and performance of required inspections

A.3 Quality Assurance

Manufacturer shall have a minimum of 10 years of satisfactory experience in the fabrication and installation of escalators equivalent to those specified and submit list of five installations of similar application.

a. Location of nearest parts warehouse.
   Names and qualifications of five people who would normally service such equipment.
b. A list of five service customers whose similar equipment has been maintained for a period of five years and names of contacts and phone numbers.
c. The fabrication and installation of the single escalators shall enable the addition of an adjacent and equivalent second escalator at a future date without causing substantial construction revisions.
d. The initial project will be providing the required lower wells and upper well landings with temporary floor closures.
   i. The initial project will detail the affected side exterior cladding to be removable and salvageable for re-installation unto the additional escalators.
   ii. The initial project will provide the foundation for the required intermediate structural support column for the added escalator.
   iii. The initial project will provide the required power supply and fused disconnects at the mezzanine level for the additional escalators

A.4 Work by Others

a. Provision of proper building dimensions and suitable framing with structural reactions and finishes in accordance to escalator shop drawings. Variations not to exceed 1" at any point.
b. Enclosure walls, railings, guards, closures, shutters as required.
c. Waterproof lower well space and pit drainage as required.
d. Non-combustible and retardant materials exterior cladding of truss and finish from the edges of the escalator deck covers, including ends, sides and bottom of truss in accordance to applicable weight restriction of 10 lbs per square foot.
e. Provision of finished concrete flooring adjacent to escalator floor plates.
f. Cutting of floors, walls, ceilings together with any repairs made necessary by such cuttings.
g. Painting and finish work required beyond that included in this section.
h. Electrical service to upper well including 3 phase main power supply feed and fused disconnects to each controller. Main Power Supply: 480 VAC 3 Ph. 60 Hz.
i. Provide single phase 120 VAC electrical service and fused disconnect for light and convenience outlet in the upper well and other electrical devices that are not part of the escalator proper that may be required by local authorities.
j. Provide 220 VAC fused disconnect to supply truss and comb-plate heating equipment.
k. Provision and wiring and conduit from the closest well-way of each escalator group to a control room or console within the existing Station Depot as required. Coordinate with escalator contractor for size, number and location of conduits.
l. Other work required for the installation of escalators included but not limited to lighting and electrical systems.
m. Provide barriers for open well-ways during construction per OSHA Regulations.
n. Protect escalator truss, steps, landing plates, balustrades, handrails and special metal finishes form damage during construction.

A.5 Submittals.

a. Product Data: Materials and finishes.
b. Shop Drawings: Layout and installation.
c. Samples: All visible finishes.
d. Operation and Maintenance Data: At contract closeout, three copies of manufacturer's standard operating and maintenance manuals.

A.6 Delivery, Storage and Handling

a. Protect finished surfaces during transport and handling. Store materials and equipment in an area protected from the elements.

A.7 Warranty and Maintenance

a. The installed escalator system shall be warranted for one year from the date of acceptance against defects in materials and workmanship.
b. The warranty shall include maintenance and call-back service on each escalator including periodic equipment examinations, adjustments, lubrication, cleaning, supplies and parts to ensure proper operation for a period of 12 months.

A.8 Commissioning

a. Perform testing and adjusting to ensure that equipment is operating properly and to contract requirements.
b. Instruct owner's representative on operational features, special features and provide operating and maintenance instructions.
c. Provide keys needed for actuation of any operating device so equipped.

B Materials

B.1 Manufacturers

a. Basis of Design Product: The design for the Heavy Duty Escalators is based on a Thyssen Krupp Elevator Tugela. Subject to compliance with the specified and detailed requirements a comparable product will be considered by:
b. Montgomery KONE Inc.
c. Otis Elevator Company
d. Schindler Elevator Corp
e. Elevator bidders are herein reminded to refer to the Notice to Contractors in the General Conditions requiring the Buy America provisions of the contract.

B.2 Metals

a. Aluminum: Extrusions per ASTM B221; sheet and plate per ASTM B209.
b. Cold Roll Steel Sheet: ASTM A366.
c. Structural Steel: ASTM A36.
d. Stainless Steel: AISI, Type 304 Series, with brushed finish as specified.
e. All steel used for the truss construction shall be sandblasted and shall be hot-dipped galvanized. All other steel components and castings shall receive protection against corrosion by two coats of anti-corrosive primer with a minimum thickness of 1.5mils.
f. Aluminium parts shall be clear anodized.

B.3 Equipment

a. Each escalator shall be of complete unit construction of the cleat-step reversible type for ascending or descending passenger service. The angle of inclination shall be 30 degrees from the horizontal. Three flat steps are required at the upper and lower landings.
   Designations: ESCPAIR 1, ESC 2, ESC 3 (ESC 2 and ESC 3 installed to eventually become a pair)
b. Dimensions.
   Step Width: 32". Combined truss width: 8'- 8 ¾"
   Overall pit width: 8'-11 1/16"
   Vertical Rise: 26'-0"
   Theoretical Capacity: 6750 Passengers per hour. Speed: 100 fpm.
c. Main Power Supply: 480 VAC 3 Ph. 60 Hz.

B.4 Outdoor Equipment

The escalators are intended for an outdoor application and shall be equipped as a minimum with the following:

a. Truss components. Provide hot-dipped galvanized truss
b. Thermostatically controlled truss and comb plate heaters.
c. All exterior fasteners finished in stainless steel. Internal fasteners to feature galvanized finish.
d. Steps with hermetically sealed bearings
e. All chains to be equipped with protective covers. Includes drive, handrail and step chains.
f. Nylon slider component for handrails.
g. Stainless steel handrail guides and tracks.
h. All electrical components to be IP54 protection–rated.
i. Automatic chain lubrication.
j. Reinforced handrail drive.
k. NEMA 4 controller housing. IP54 electrical class.
l. Stainless steel skirt panels.
m. Oil/water separator and drainage port in lower well.

C Construction

C.1 Fabrication

C.1.1 Truss

a. The main truss sides shall be a lattice girder construction welded from steel profiles with a 1/8" liquid-tight soffit plate welded to the main truss side members. Tubular truss members are not permitted. There shall be no diagonal or bracing members secured to the inside face of the soffit in order to prevent the accumulation of dirt and dust. The truss shall have a factor of safety as prescribed by ANSI/ASME A17.1. The truss shall be designed for rigidity and strength to carry the passenger capacity load and machinery components including balustrades, and the weight of exterior covering not exceed 10 pounds per square foot. *The main truss deflection under full load conditions shall not exceed 1/1000 of the support distance.*

C.1. 2 Isolation Mounting

a. The support angles at both ends of the main truss shall be mounted on isolation pads to prevent transmission of noise and vibration to the building structure. Readjustment of the escalator alignment shall be possible at any time by means of jack bolts at the supports. Prepare supports to suit local seismic zone requirements.
b. Noise levels. The escalator noise level shall not exceed 55 dB when measured at a height of 3 feet above the comb plate assembly.

C.1.3 Drive Machine

a. A virtually noiseless escalator drive machine shall be located within the top end of the escalator well, outside of the step band. The complete drive unit including brake and speed governor *must be easily accessible without removal of steps*.

b. The AC escalator drive motor with flanged reduction gear shall be arranged vertically. The connection between drive motor and reduction gear shall be via a flexible coupling, suitable to dampen the start-up movement.
c. The reduction gear shall be located in a mono-block housing. A combined bevel and spur gear (helical-design) or worm gear shall be used as reduction gear. A circulating pump for oil cooling is not permitted.
d. Synthetic oil shall be used in order to prolong the intervals between oil changes. The main shaft shall be driven with chain transmission via triplex chain as a minimum. The step chains with 3" diameter poly-urethane rollers shall intermesh with the chain rollers to provide a smooth run of the steps. *The step chains shall have a minimum breaking load strength of 160 Kn.*
e. The complete drive assembly shall have a power factor of not less than 0.86.

C.1.4. Motor

a. The escalator motor shall be an AC flange mounted unit, coupled to the reduction gear and the motor shall be protected by electro-magnetic overload devices and thermistors within the motor. A fly-wheel shall be provided on the upper end of the shaft of the driving motor designed to facilitate mechanical-hand winding of the escalator.
b. The escalator shall be able to start under full load conditions. The driving motor shall be protected to NEMA 3 or IP54 as a minimum. Starting current shall not exceed 4 times the running current. Motor rating shall be stated in the bid submission and shall be a minimum of 10% greater than that of the manufacturer's commercial escalator product.
c. The drive motor shall operate at a maximum speed of 1200 rpm maximum at a voltage frequency of 60Hz.

C.1.5. Brake

a. A dual circuit fail safe brake system consisting of a brake release solenoid with two separate lifting pins and independently operating brake shoes shall be provided on the drive motor shaft. Each brake shoe shall be able to stop the fully loaded step band. The electro-mechanical safety brake shall have a large diameter with a maximum brake surface pressure of 29 p.s.i. (200 kPa) on the brake lining in order to prolong its life.
b. For safety reasons, the possibility of hand winding via the flywheel on the free shaft end shall be provided within the upper well.
c. The brake must be designed for a minimum loading of 265 lb (120 kg) per step with escalator running.
d. An auxiliary main-shaft brake shall be provided per Code requirements for escalators utilising chain connection between the drive machine and main shaft. The auxiliary brake shall be capable of stopping the fully-loaded escalator within the code-rated stopping distance.

C.1.6 Controller

a. Main switch, motor protection and control devices shall be installed in an outdoor-exposure, NEMA-4 rated cabinet that shall be situated in the upper machinery space of the escalator. The cabinet shall be supplied according to ANSI/ASME standards by the escalator manufacturer, with all required relays, automatic circuit breaker and terminals completely wired for the escalator control. Fault annunciation shall be provided to identify activation of specific escalator safety devices.
b. The escalator controller shall incorporate an electronic fault diagnostic system to log statistical data on the operation of the escalator and include memory to store escalator fault causing shut down.
c. The controller and fault diagnostic system located in the upper well shall include a clear text display to allow immediate identification of the cause of a shutdown. The display system shall provide 2 lines of 20 characters minimum for displaying programmable messages and fault conditions. Operation of the fault diagnostic system shall be possible at the display point via menus and keypads adjacent to or contained as part of the display system.
d. Each escalator shall be provided with a pendant style running button assembly to operate the escalator during maintenance. Plug-in connection devices for the pendant station shall be provided at both ends of the escalator within the well space beneath the floor plates. The pendants shall include constant-pressure push buttons to operate the escalator in either direction and must be equipped with a maintenance-operation stop button. A minimum of 10'-0" of cable shall be provided.

C.1.7. Upper Reversing Station.

a. The upper reversing station and drive shall include precision-machined step chain and handrail drive sprockets on a common shaft rotating on roller bearings. The drive shall be designed to substantially match speeds of the step band and handrails.
b. Mechanical guards shall be provided at the step band return area to improve safety for workmen within the machinery space.

C.1.8. Lower Reversing Station

a. A *heavy-duty, sprocket-designed* step chain tensioning device shall be mounted upon pedestal bearing supports at the escalator bottom end within the main truss and be easily accessible. The stepchain rollers shall not bear the tension.
b. Constant and even tension of the step chains shall be achieved by two heavy-gauge adjustable compression springs.
c. Mechanical guards shall be provided at the step band return area to protect maintenance personnel working within the machinery space.
d. A permanently installed switch to eliminate the power during maintenance and repair work shall be provided in the lower reversing station.

C.1. 9 Step Band

a. Consecutively running steps powered and spaced with heavy chain designed for long life and quiet operation. Two high precision rolled flat link hardened chains with a maximum pitch of 5.313" shall be provided to connect the steps to an endless step band. The chains shall have neoprene rollers with ball bearings on each link bolt in order to provide a silent run of the step band. Minimum chain breaking strength shall be 31,472 pounds (160 kN) and upgraded according to rise.
b. Chains forming the step band shall include neoprene rollers at the step support points. Rollers shall include lifetime sealed lubricated ball bearings with a minimum dynamic load capacity of 2200 lbs (1000 kg) and shall be no less than 3” inches in diameter.
c. Chain pins between step support points shall be provided with intermediate neoprene rollers to increase the operating efficiency of the escalator. These rollers shall be provided with lifetime lubricated ball bearings or journal bearings. If journal bearings are used, roller diameters shall be somewhat smaller than those at the step support points to prevent twisting of the chain on the straight sections of guide tracks.

C.1.10 Steps

a. Fully die-cast aluminium interchangeable units. Under a load of 1320 lbs. (600 kg.), the deflection at the center of the steps shall not exceed 0.047" (1.2 mm). No permanent deformation shall remain upon removal of the load. The step risers shall be grooved and inter-mesh with the leading edge of the adjacent step tread thus increasing the safety. The interchangeable die-cast steps shall have grooved treads of 0.226" (5.75 mm) width. Steps shall have a safety factor load rating of no less than 13.5 times ASME code requirement.
b. Each step shall run on four rollers which consist of aluminium bodies fitted sealed bearings, and long-life neoprene vulcanized to the body. The dynamic carrying capacity of each step roller bearing shall be at least 2200 lbs. (1000 kg.) and have a diameter of not less than three inches.
c. The replacement of steps shall be performed without the removal of the decking or skirting panels.
d. Steps shall be powder-coated with a silver finish and provided with yellow demarcation lines on each side adjacent to the skirt panel and at the rear edge of the step tread.
e. Step guide rails on the passenger side shall be formed using U profiles from lacquered sheet steel to protect the chain from external influences. All other track shall be formed using galvanized sheet steel.

C.1.11 Comb Plates and Floor Plates

a. The comb plate assemblies at the upper and lower escalator ends shall be fitted with easily exchangeable comb segments made from a special cast aluminium alloy, and with comb teeth engaging deeply with the step tread surface. Step inlet guides at top and bottom landing shall ensure an accurate meshing of steps into the comb segments. Each comb-plate shall be fitted with safety contacts to stop

the escalator if a foreign object is caught between the comb teeth and the step. The area where the steps enter the comb-plates shall be illuminated by lights, installed in the skirt panel at both sides of the escalator. (The maximum distance between the upper surface of the tread and the upper surface of the comb-plate shall be 1-13/16" (45 mm).

b. The floor plates covering the machinery spaces at each escalator end shall be removable lightweight plates of rigid construction and shall have a ribbed stainless steel surface with a non-slip grooved design. The floor-plate assembly shall be able to withstand a live load rating of 250 lbs. without permanent distortion. The floor-plate shall be set to finished floor level.

C.1.12 Control

a. A control station at both upper and lower landings shall be provided which includes a key actuated direction starting safety switch and a key actuated stop switch. The control station shall be located in the newel end skirt deck at the ends of the balustrades.
b. A code compliant emergency stop station shall be provided at each end of the escalator, located in accordance to governing Code requirements and shall be covered by a transparent cover and alarm.
c. Starting of the escalator in normal continuous operation mode shall only be possible using a safety key switch.

C.1.13 Handrails and Handrail Drives

a. The two endless handrails shall consist of a black synthetic rubber compound with low-stretch steel cord reinforcing and side plies of nylon. The handrail entries at the balustrade ends shall be equipped with handrail inlet plates or brushes fitted with safety contacts. Handrail inlet devices shall be designed to activate when an obstruction enters the device reducing potential injury to the object entering the device. The handrails shall be driven in both directions synchronously with the step band via the main shaft. Handrails shall have a minimum breaking strength of 3600 lbf (16 kN).
b. The handrail shall be pressed against a rubber-rimmed driving wheel by a heavy-duty cluster roller assembly. The handrail drive shall be situated in the upper landing area of the escalator.
c. Handrail newel ends shall be provided with a minimum radius of 17.32" (440mm) to provide long handrail life. Newel ends shall be furnished with rollers fitted with bearings to minimize handrail wear.
d. Handrails shall be centrally located on the balustrade.
e. Guide tracks used for the handrails shall be constructed of stainless steel.

C.1.14 Safety Devices

a. Chain safety contacts to ensure the immediate stopping of the machine in the event of excessive chain stretch or breakage.
b. Horizontal and vertical comb plate contacts to operate and stop the escalator if the comb plate is moved from its normal working position when objects are lodged between the treads and the comb plate.

c. Handrail inlet safety devices at the entrance of the handrails into the balustrades. These switches when tripped shall immediately stop the escalator in order to avoid passenger injury or equipment damage.
d. Controller phase loss protection.
e. Emergency stop push buttons with covers and audible alarm located at each end of the escalator in the balustrade decking and newel.
f. Maintenance cable sockets in both upper and lower reversing stations.
g. Means for hand winding of fly-wheel in order to manually move the steps.
h. Step running control devices within the step band with 5 actuation points at each and of the escalator. System designed to stop the escalator if and when damage to the steps or rollers occurs.
i. Speed governor for the control of overspeed and / or unintended reversal.
j. Secondary brake located on main drive shaft.
k. Stop switches as control circuit breakers in both reversing stations.
l. Protective maintenance guards in reversing stations.
m. Missing step and broken-step device.
n. Handrail speed monitoring device.
o. Lighting in reversing stations.
p. Ground lugs shall be provided to ground the truss to the building ground system
q. Green fluorescent step demarcation lights under steps at top and bottom (2 tubes).
r. Four skirting micro switches (two at each landing) to stop the escalator if a foreign object becomes wedged between the step and the skirting.
s. Skirt safety brushes.
t. Step up-thrust device at lower landing to stop the escalator if a foreign object becomes wedged between the riser and tread of adjacent steps.

C.1.15 Balustrades

a. Handrails shall be directly supported on formed steel guides mounted on top of the balustrade. Balustrade height shall be a consistent 39.37" (1000 mm) for the entire length of the escalator.
b. Clear glass panels constructed of ANSI Z97 code rated tempered glass with a thickness of 3/8” with glass joints vertical in reference to the landing’s horizontal plane.
c. Stationary skirt panels adjacent to the step must be rigid and permanently coated with a friction-reducing compound. Skirting shall be finished in AISI 304 brushed no. 4 stainless steel. Skirt panels shall be designed and constructed to meet ASME A.17.1- 2000-2002 or the latest code requirements regarding loaded gap / skirt deflection performance.
d. Skirt panels shall be designed to provide a flush transition between the skirt and inner decking above with no protruding edges. The skirt height along the entire length of the escalator shall be at least 7 1/4" at right angles to the step running line.
e. Decking profiles on both side of the step running line shall be parallel to the step running line and shall transition in wide arcs from horizontal to inclined portions of the escalator. The decking profiles shall consist of sturdy stainless steel with AISI 304 with no. 4 brushed finish.

f. Since the escalators will be exposed to direct sunlight at least part of the day, the manufacturer shall include provisions to accommodate the impact of thermal expansion where dissimilar materials are used for balustrade and decking components.

C.2 Installation

C.2.1 Examination

a. Verify that the building conditions are suitable for the commencement of the escalator work described in this section.
b. Verify building support dimensions are of correct size and within tolerances.
c. Confirm electrical power is available and suitable for hook-up.
d. Report any defects or deficiencies.
e. Do not proceed with work until satisfactory conditions are corrected.
f. Arrange for temporary electrical power to be available for installation work and testing of escalator components.

C.2.2 Installation

a. Install in accordance to ANSI/ASME A17.1-2000 and applicable local codes.
b. Install escalator components as specified and required for a complete operating escalator system.

C.3 Field Quality Control

a. Perform periodic field inspection as work is performed to confirm installation in accordance to project requirements.
b. Perform system testing to verify that the required performance criteria has been met.
c. Furnish test and approval certificates issued by jurisdictional authorities.

C.4 Demonstration

a. Arrange for and perform a final check of escalator operation with the owner or owner's representative present prior to turning each escalator over for use.
b. Demonstrate to the owner a complete operating system

D Measurement

The department will measure Heavy Duty Escalators as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.32	Heavy Duty Escalators	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

56. Precast Concrete Patching, Section 03 41 20, Item SPV.0105.33.

A Description

A.1 General

This special provision describes the performance criteria, materials, production, and installation of exposed aggregate concrete patches in beam and wall openings in the existing precast wall panels on the south wall of the station building that will required by the removal of the ramp and related roof slabs north the train shed columns, and of masonry patches required as a result of modifications to the north wall of the existing brick shed shown on the selective demolition and revisions plan.

The work performed under this section includes all labor materials, equipment, related services and supervision required for the patching work performed under this section includes all labor, material, equipment, related shown on the Contract Drawings, inferable there from and specified herein.

The patching of precast concrete panels includes:

a. The closure of steel beam perforations on the south wall panels.
b. The patching of existing roof flashing reglets on the south wall panels.
c. The closure of a new spandrel panel, over the new automatic doors, the full width of the entrance/egress passage between the Station Building and the Train Shed.

A.2 Related Work Specified Elsewhere

a. Concrete Structures
b. Section 05 50 00: Metal Fabrications
c. Section 07 92 00: Sealants
d. Section 08 46 00: Automatic Entrance Doors
e. Section 09 91 00: Painting.

A.3 Submittals

a. Product data for each type of product used in the implementation of the patching system.
b. Design mixes for patching mixture; slump, aggregate, bonding agents.
c. Product data on retardants required to obtain the exposed aggregate finish to match the adjacent panel finish.
d. Details of reinforcing, and the anchors and connections to the existing panels.
e. Installation procedures, number of grouting passes and curing times.

A.4 Samples.

a. Provide a 12" x 12" sample for review in the field to match the existing precast concrete surface.
b. Upon approval of the sample prepare a field mock-up in one of the beam openings that will illustrate the interface between the patch and the surrounding existing panel.

A.5 Quality Assurance

a. A firm that is experienced in the repair of precast concrete panels, similar to those indicated for this project and with a record of successful-in-service performance.
b. Deliver all patching materials in original containers and store in raised pallets under weather protected conditions.

B Materials

B.1. Reinforcing and Form

a. Deformed Reinforcing Bars: ASTM A 615/A 615M, Grade 60.
b. Plain Steel Wire: ASTM A 82, as drawn.
c. Tie Wire: Annealed steel, minimum 16 gauge size.
d. Steel Sheet Form: Galvanized, 18 gage, ASTM A 653 Grade 33.
e. Expanded Metal Lath: ASTM C 847, except as modified by ASTM C 841.

B.2 Cement and Aggregate

a. Portland Cement: ASDTM C 150, Type II or I.
b. Aggregates: ASTM C 33 uniformly graded to match surface of adjacent precast concrete panels.
c. Natural sand ASTM C 35.
d. Air-Entraining Admixture ASTM C 260 Chemical Admixtures ASTM C 494 water reducing and accelerating and water reducing and retarding agents.
e. Bonding Agents: ASTM C 631.

B.3 Sealants

a. Refer to Specification Section 07 92 00.

C Construction

C.1 Surface Preparation, Formwork and Reinforcing.

a. Prepare and condition the panel voids by removing projections to ensure proper mechanical key.
b. Install sheet metal back form securely fastened to prevent any movement during the application of concrete mix.
c. Apply bonding agent to edges a sound panel wall around the openings.
d. Install reinforcing and perimeter dowels fastened and drilled into the sides of panel voids.

C.2 Concrete Application and Finish

a. Proportion mix with a slump that will enable a multiple coat application.
b. Dampen substrate with water spray mist.
c. Trowel mix into and through reinforcing, insuring a tight, void free installation.
d. Build up patch, allowing each coat to set and harden.
e. Apply a finish coat allowing the surface to project above the existing adjacent surface, taking into account the application of a retarder and removal of the matrix by methods recommended by the retarder manufacturer in order to match the existing exposed aggregate finish.

C.3 Curing and Protection

a. Retain moisture and maintain a reasonably constant temperature for the duration of the curing period.
    i. Type I Cement: 5 days
    ii. Type II Cement: 7 days
    iii. Curing Temperature: Min 50 degrees F; Max 90 degrees F.
b. Protect the cured surfaces from damage by other trades and traffic.
    i. Cold weather protection in full compliance with ACI 306.
    ii. Hot weather protection in full compliance with ACI 305.

D. Measurement

The department will measure Precast Concrete Patching as a single lump sum unit of work, acceptably completed.

E. Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.33	Precast Concrete Patching	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

57. Exhaust Ventilators, Section 23 34 23, Item SPV.0105.35.

A Description

A.1 General

The fabrication, furnishing and installation of powered exhaust ventilators and all required accessories and hardware as shown on the drawings, inferable there from and specified herein.

The work specified in this section includes: the powered exhaust ventilators located on the roof of the shed.

Coordinate exhaust ventilator curb installation with EDPM Membrane Roofing, 07 53 00 and Sheet Metal Gutters and Flashing specified under 07 61 00.

Coordinate electrical connections to exhaust ventilators with Building Wire and Cable, Section 26 05 19; HVAC Electrical Connections and Motor Starters, Section 23 05 10; Electric Instrumentation and Control Devices for HVAC, Section 23 09 14 and HVAC Fans, Section 23 34 00.

A.2 Performance Ratings

Conform to AMCA standard 211 and 311. Fans must be tested in accordance to ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall be certified to bear the AMCA label for air and sound performance seal.

Classification for Spark Resistant Construction, levels A, B, and C conform to AMCA 99.

Each fan shall be given a balancing analysis which is applied to wheels at the outside radius. The maximum allowable static and dynamic imbalance is 0.05 ounces (Balance grade of G6.3).

Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.

The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at the manufacturer's option when returned to manufacturer, transportation prepaid.

Motor is to be warranted by the motor manufacturer for a period of one year. Should motors furnished by fan manufacturer prove defective during this period, they will be replaced at the manufacturer's option when returned to manufacturer, transportation prepaid.

B Materials
B.1 Fans
B1.1 General Description
Fans shall discharge air up and away from the mounting surface.

Upblast fan shall be designed for high wind roof mounted applications and tested to withstand winds up to 150 MPH.

Fans shall ventilate at a rate of 7,000 cubic feet per minute (cfm) at a static pressure of 1.0 inch of water gauge.

Fans shall have 30 inch wheel diameter.

Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

B.1.2 Wheel

a. Material type: non-stick coating.
b. Non-overloading, backward inclined centrifugal.
c. Statically and dynamically balanced in accordance to AMCA Standard 204-05.
d. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

B.1.3 Motor

a. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.
b. Mounted on vibration isolators, out of the airstream.
c. For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants.
d. Accessible for maintenance.

B.1.4 Shafts and Bearings

Material type: non-stick coating

B.2 Roof Curbs

a. Types: H-GPF
b. Mounted onto roof with fan, curb shall compensate for sloped roof to provide level surface for fan.
c. Material: Steel (Galvanized)
d. Coating Type: Baked Enamel

B3 Fan Control

B3.1 Description

Each fan shall be controlled by sensor monitoring nitrogen dioxide concentration.

B3.2 Sensor and controller

Sensor shall be electrochemical nitrogen dioxide detector capable of detecting nitrogen dioxide concentrations between 0.8 and 6 PPM. Sensor shall be capable of operation in outdoor conditions in Milwaukee.

Sensor shall be accurate to +/- 5% of the calibrated value for a period of one year in operation.

Sensor shall be capable of easy replacement without removing and disconnecting control unit, or capable of recalibration in the field.

Controller shall have capability for multiple concentration set points and time delays.

B3.3 Control Sequence

If nitrogen dioxide concentration exceeds the set point and remains above the set point for five minutes, the fan shall be started.

Fan shall remain on until nitrogen dioxide concentration falls below the set point and remains below the set point for five minutes.

Each fan shall have a unique nitrogen dioxide set point as given in the following table:

Fan	NO_2 concentration set point
EF-1	1.0 ppm
EF-2	2.0 ppm
EF-3	3.0 ppm

The set point and delay shall be capable of modification after installation.

B4 Submittals
Shop drawings, product data and samples.

Submit dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification, and vibration isolation for equipment. Sound power levels to be based on tests performed in accordance to AMCA Standard 300.

Fan curves shall indicate relationship of CFM to static or total pressure for various fan speeds.

Indicate brake horsepower, recommended selection range, and limits of operation on curves.

Indicate operating point on fan cures at design air quantity and indicate manufacturer's recommended drive loss factor for specific application.

Tabular fan performance data is not acceptable.

Submit product data for nitrogen dioxide sensor and fan control unit including sensor concentration range and calibration, concentration set points, delay set points, and ambient temperature operating range.

C Construction
C.1 Delivery and Handling
C.1.1 Delivery
Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.

C.1.2 Storage
Store materials in a dry area indoor, protected from damage, and in accordance to manufacturer's instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual.

C.1.3 Handling
Handle and lift fans in accordance to the manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.

C.2 Installation
C.2.1 Compliance

a. Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions.
b. Examine areas to receive fans. Notify the engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected.
c. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance. Ensure curb is plumb, sized correctly, and to proper elevation above roof deck.
d. Install fans system as indicated on the Installation, Operation and Maintenance Manual (IOM) and contract drawings. Install fans in accordance to manufacturer's instructions.
e. System Startup: Refer to Installation, Operation, and Maintenance Manual (IOM).

D Measurement
The department will measure Exhaust Ventilators as a single lump sum unit of work for exhaust ventilators, 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.0105.35	Exhaust Ventilators	LS

Payment is full compensation for furnishing and installing all exhaust ventilators as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

58. Gravity Ventilators, Section 23 37 00, Item SPV.0105.36.

A Description
The fabrication, furnishing and installation of gravity/wind exhaust turbine ventilators and all required accessories and hardware as shown on the architectural drawings, inferable there from and specified herein.

The work specified in this section includes: the gravity/wind exhaust turbine ventilators located on the roof of the train shed.

Coordinate gravity/wind exhaust turbine ventilators installation with Metal Roof Deck, Section 05 30 00 and EPDM Membrane Roofing, Section 07 53 00.

Gravity Ventilators shall be Hurricane™ Turbine Ventilator Model H900 with a Type 1 Base as manufactured by CRS Edmonds, and represented by Envira-North Systems Ltd. – Seaforth, ON, Canada (866) 771 7766.

Gravity Ventilator Bidders are herein reminded to refer to the **Notice to Contractors** in the General Conditions requiring the **Buy America** provisions of the contract.

The Turbine Ventilators shall be certified to withstand 240 Km/hr wind without damage and a Low Speed Dynamic Rain Penetration Test of 3L/m@57.4,/hr as tested by Construction Research Laboratories of Miami, FL.

Manufacturer's Warranty of 15 years shall be included.

B Materials
B.1 Materials
Turbine Throat Aluminum 5055 H 34
Shaft (H 900 only) 303 Stainless Steel
Dome: Aluminum 1200 HO
Brackets: Aluminum 6060 – T 591
Spider (H 900 only) Zinc passivate plated mild steel
Main Bearing Holder Assembly, glass reinforced nylon 6
Main Bearing: Double Row Ball Bearing BWF 30-119Z
Spider Bearing (H 900 only) single row ball bearing As 204

Fasteners of the same material and alloy as fastened metal or 300 Series stainless steel. Dampers shall not be provided and turbines hall incorporate a TADECO pre-packaged bearing system.

Air Exhaust Capacity shall be:
3,300 cfm @ 3.7 mph wind velocity
5,700 cfm @ 7.5 mph wind velocity
7300 cfm @ 9.9 cfm wind velocity

B.2 Submittals
Shop drawings, product data and samples.

Submit shop drawings of ventilators including dimensioned plan and section drawings for coordination with roofing contractor.

C Construction
C.1 Installation
Mount ventilators on sheet metal base, setting accurately in location, alignment and elevation with edges and surfaces level, plumb, true and free of rack. Ventilators shall be installed level, adjusted for roof slope.

Coordinate ventilator installation with installation of membrane roofing.

D Measurement
The department will measure Gravity Ventilators as a single lump sum unit of work for gravity ventilators, 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.0105.36	Gravity Ventilators	LS

Payment is full compensation for furnishing and installing all gravity ventilators as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

59. Plumbing Work, Item SPV.0105.37

A Description
This general provision describes all plumbing work as shown on the plans, provided in the contract and as described in the applicable sections of the following general articles:

a. Basic Plumbing Materials and Methods Section 22 05 00
b. Pipes and Tubes for Plumbing Piping and Equipment Section 22 05 03
c. Motor Requirements for Plumbing Equipment Section 22 05 13
d. Plumbing Specialties Section 22 05 14
e. Valves for Plumbing Piping Section 22 05 23
f. Hangers and Supports for Plumbing Section 22 05 29
g. Facility Storm Drainage Section 22 14 00
h. Plumbing Equipment Section 22 30 00

B Materials
All materials shall conform to the applicable sections of the following general articles:

a. Basic Plumbing Materials and Methods Section 22 05 00
b. Pipes and Tubes for Plumbing Piping and Equipment Section 22 05 03
c. Motor Requirements for Plumbing Equipment Section 22 05 13
d. Plumbing Specialties Section 22 05 14
e. Valves for Plumbing Piping Section 22 05 23
f. Hangers and Supports for Plumbing Section 22 05 29
g. Facility Storm Drainage Section 22 14 00
h. Plumbing Equipment Section 22 30 00

C Construction
All construction shall conform to the applicable sections of the following general articles:

a. Basic Plumbing Materials and Methods Section 22 05 00
b. Pipes and Tubes for Plumbing Piping and Equipment Section 22 05 03
c. Motor Requirements for Plumbing Equipment Section 22 05 13
d. Plumbing Specialties Section 22 05 14
e. Valves for Plumbing Piping Section 22 05 23

f. Hangers and Supports for Plumbing Section 22 05 29
g. Facility Storm Drainage Section 22 14 00
h. Plumbing Equipment Section 22 30 00

D Measurement
The department will measure Plumbing Work as a single lump sum unit of work for all plumbing 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.0105.37	Plumbing Work	LS

Payment is full compensation for furnishing and installing all electrical work as per the plans, details, and the following general articles: Basic Plumbing Materials and Methods Section 22 05 00, Pipes and Tubes for Plumbing Piping and Equipment Section 22 05 03, Motor Requirements for Plumbing Equipment Section 22 05 13, Plumbing Specialties Section 22 05 14, Valves for Plumbing Piping Section 22 05 23, Hangers and Supports for Plumbing Section 22 05 29, Facility Storm Drainage Section 22 14 00, Plumbing Equipment Section 22 30 00; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

60. Basic Plumbing Materials and Methods, Section 22 05 00.

A Description
A.1 Summary
Section Includes:
a. Reference Standards.
b. Quality Assurance.
c. Continuity of Existing Services.
d. Protection of Finished Surfaces.
e. Sleeves and Openings.
f. Sealing and Firestopping.
g. Submittals.
h. Codes.
i. Request and Certification for Payment.
j. Certificates and Inspections.
k. Operating and Maintenance Instructions.
l. Training of Owner Personnel.
m. Record Drawings.
n. Access Panels and Doors.
o. Identification.
p. Sealing and Firestopping.
q. Bedding and Backfill.
r. Demolition.
s. Excavation and Backfill.

t. Sheeting, Shoring and Bracing.
u. Dewatering.
v. Rock Excavation.
w. Surface Repair.
x. Concrete Work.
y. Cutting and Patching.
z. Building Access.
aa. Equipment Access.
bb. Coordination.
cc. Identification.
dd. Lubrication.
ee. Sleeves.
ff. Sealing and Firestopping.

Related Sections
This section applies to all Division 22 specification sections related to plumbing.

A.2 References
American Concrete Institute: (ACI)

a. ACI 614 - Recommended Practice for Measuring, Mixing and Placing of Concrete.

ASTM International: (ASTM)

a. ASTM D1557 - Test Method for Moisture-Density Relations of Soils.
b. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.
c. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
d. ASTM E814 - Test Method for Fire Tests of Through-Penetration Fire Stops.

State of Wisconsin Department of Transportation: (WISDOT)

a. Standard Specifications for Highway and Structure Construction, Current Edition, including latest supplements.

Underwriters Laboratories, Inc.: (UL)

a. UL1479 - Fire Tests of Through-Penetration Firestops.
b. UL723 - Surface Burning Characteristics of Building Materials.

A.3 Reference 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.
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.
MCA: Mechanical 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.
NSF: National Sanitation Foundation.
PDI: Plumbing and Drainage Institute.
UL: Underwriters Laboratories Inc.

A.4 Quality Assurance
Substitution of Materials: Reviewed by engineer.

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, contractor is responsible for all costs involved in integrating equipment or accessories into system and for obtaining intended performance from system into which these items are placed.

A.5 Continuity of Existing Services
Do not interrupt or change existing services without prior written approval from owner's project representative.

When interruption is required, coordinate scheduling of down-time with owner to minimize disruption to his activities.

Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

A.6 Protection of Finished Surfaces
Protect finishes of surface from defect.

A.7 Sleeves and Openings
Provide sleeves at all penetrations through walls and footers, as detailed in this section.

A.8 Sealing and Firestopping
Sealing and firestopping of sleeves and related openings between piping and sleeve and structural opening shall be responsibility of contractor whose work penetrates opening.

Contractor responsible shall provide individuals skilled in such work to do sealing and fireproofing.

A.9 Governing Agencies
Comply with requirements of State and local plumbing codes.

A.10 Certificates and Inspections
Contractor is responsible for obtaining permits, inspections and fees.

A.11 Submittals
Submit six hard copies of equipment and materials or one PDF.

Shop Drawing submittals are to be bound, labeled, contain project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with installation.

Submit for all equipment and systems as indicated in 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 number, as indicated in contract documents. Include wiring diagrams of electrically powered equipment.

Firestopping System Submittals:

a. Contractor shall submit product data for each firestop system.
b. 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.
c. 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.

A.12 Operating and Maintenance Instructions
Operating and maintenance instructions shall be provided as follows:

a. Assemble material in three-ring or post binders, using an index at front of each volume and tabs for each system or type of equipment.
b. In addition to data indicated in the General Requirements, include the following information:
c. Copies of all approved shop drawings.
d. Manufacturer's wiring diagrams for electrically powered equipment.
e. Records of tests performed to certify compliance with system requirements.
f. Certificates of inspection by regulatory agencies.
g. Parts lists for fixtures, equipment, valves and specialties.
h. Manufacturers' installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
i. Valve schedules.
j. Lubrication instructions, including parts list and frequency of lubrication.
k. Warranties.
l. Additional information as indicated in technical specification sections.

A.13 Training of Owner Personnel
Instruct owner personnel in proper operation and maintenance of systems and equipment provided as part of this project.

Include not less than 2 hours of instruction, using Operation 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.

A.14 Project Record Documents
Shall be provided showing actual installation with dimensioned drawings for all piping and equipment.

B Materials
B.1 Identification
Stencils: Provide not less than one-inch high letters and numbers for marking pipe and equipment.

Engraved Name Plates: Provide white letters on a black background, 1/16-inch thick plastic laminate, beveled edges, screw mounting.
Manufacturers:
Setonply Style 2060 by Seton Name Plate Company
Emedolite Style EIP by EMED Company
W. H. Brady
Or approved equal.

Snap-Around Pipe Markers: Provide one-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, 3/4-inch minimum size for lettering. Provide nylon ties on each end of pipe markers.
Manufacturers:
Seton Setmark
Brady Snap-On™ and Strap-On Pipe Markers
Or approved equal.

Valve Tags: Provide 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 valve stem.
Manufacturers:
EMED Company
Seton Name Plate Company
W. H. Brady
Or approved equal.

Underground Warning Tape: Detectable underground warning tape, 5.0-mil overall thickness, 6-inch width, 0.0035-inch 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.
Manufacturers:
Thor Enterprises
Magnatec by Carlton
MSI Marking Services
Seton
Or approved equal.

Underground Tracer Wire:

a. All underground non-metallic sewers, water services and mains shall be provided with tracer wire installations.
b. Tracer wire installations shall conform with State and local code requirements.
c. Tracer wire shall be continuous solid copper or steel plastic coated with split bolt or compression-type connectors.

B.2 Bedding, Cover and Backfill
Place and compact bedding and cover 12 inches above top of pipe, compacted to 95 percent modified proctor.

Bedding, cover and backfill shall meet 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 bedding and cover material in lawn areas shall be thoroughly compacted to density equal to adjacent soil and excavated material shall be free of large rocks, perishable, and frozen materials.

Backfill above bedding and cover material under existing and future utilities, paving, sidewalks, curbs, roads, and buildings shall be approved aggregate materials such as sand, gravel, or crushed stone and shall be compacted to 95 percent modified proctor.

Backfill material shall be free of large rocks, organic, perishable, and frozen materials.

B.3 Sealing and Firestopping

Firestopping Systems
Manufacturers:
3M
Hilti
Rectorseal
STI/SpecSeal
Tremco
Or approved equal.

Firestopping systems shall be provided by same manufacturer.

a. Fire stop systems shall be UL listed, and tested by an independent testing laboratory and approved by authorities having jurisdiction.
b. Use a product that has a rating not less than rating of wall or floor being penetrated.
c. Reference architectural drawings for identification of fire and smoke rated walls and floors.
d. 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.
e. Provide mineral wool backing where specified in firestopping manufacturer's application detail.

Non-Rated Penetrations

a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between uninsulated pipe and cored opening or a water-stop type wall sleeve.
b. Operating bolts of mechanical type seal shall be accessible from interior of building.
c. At pipe penetrations of non-rated interior partitions, floors and exterior walls, use polyurethane caulk in annular space between pipe insulation and sleeve.
d. For non-rated drywall, plaster, or wood partitions where sleeve is not required use polyurethane caulk in annular space between pipe insulation and wall material.

C Construction

C.1 Demolition

Perform all demolition as indicated on drawings to accomplish new work.

Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize extent of contamination of occupied space.

Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with owner to minimize disruption to existing building occupants.

Pipe, fixtures, equipment, wiring and associated conduit, insulation, and similar items demolished, abandoned, or deactivated are to be removed from site by contractor except as specifically noted otherwise.

Designated equipment is to be turned over to owner for use at a place and time so designated.

Maintain condition of material and equipment that is indicated to be reused equal to that existing before work began.

C.2 Excavation and Backfill

Perform excavation and backfill work necessary to accomplish indicated plumbing systems installation.

Excavate to bottom of pipe and structure bedding, provide minimum of 4 inches in stable soils, 6 inches in rock or wet trenches, and 8 inches in unstable soil. Prepare bottoms of excavations to true, level surface.

At no time place excavated materials where materials will impede surface drainage unless such drainage is being safely rerouted away from excavation.

Verify locations of any water, drainage, gas, sewer, electric, telephone, or steam lines which may be encountered during excavation.

Underpin and support all lines. Cut off service connections encountered which are to be removed at limits of excavation and cap.

Elevations shown on drawings 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 grades indicated on drawings.

Bed pipe up to 12 inches above top of pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

Mechanically compact bedding and backfill to prevent settlement.

Initial loose backfill lift to not exceed 24 inches, compacted to 95 percent modified proctor density in accordance to ASTM D1557.

Subsequent loose lifts under pavements, curbs, walks, and structures are not to exceed 12 inches and be compacted to 95 percent modified proctor density.

In all other areas where construction above excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24 inches to 95 percent modified proctor density.

Place compaction equipment over each lift of material so that compaction equipment contacts all areas of surface of lift.

Excavate whatever materials are encountered as required to place pipe, manholes, and other work at elevations shown.

Remove debris and rubbish from excavations before placing bedding and backfill material.

Remove sidewalk and curb in areas of excavation to nearest joint. Remove pavements, curbs, and gutters to neat and straight lines to limits of removal.

Provide sawcut lines parallel to existing joints, or parallel or perpendicular to pavement edges to form a neat patch.

Carefully remove remaining pavement within sawcut area.

Leave existing base materials between area disturbed by removal work and sawcut line undisturbed by sawcutting, pavement removal, or pavement replacement processes.

Strip topsoil from area to be excavated, free from subsoil and debris, and store for later respreading.

Remove surplus excavated materials from site.

Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

Install lines passing under foundations with minimum of 1-1/2-inch clearance to concrete and ensure there is no disturbance of bearing soil.

C.3 Sheeting, Shoring and Bracing
Provide shoring, sheet piling, and bracing in conformance with state and local codes to prevent earth from caving or washing into excavation.

Shore and underpin to properly support adjacent or adjoining structures.

Abandon in place shoring, sheet piling. and underpinning below top of pipe, or, if approved in advance by owner's representative.

C.4 Dewatering
Provide, operate and maintain pumps and other equipment necessary to drain and keep all excavation pits, trenches and entire subgrade area free from water under all circumstances.

Obtain general permit from authorities having jurisdiction for discharge of construction dewatering effluent. Obtain well permit from authorities having jurisdiction for dewatering wells discharging more than 70 GPM. Comply with permit requirements.

C.5 Concrete Work
Cast-in-place concrete within building will be performed by concrete contractor unless otherwise noted.

Provide layout drawings, anchor bolts, metal shapes, and 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 with Division 3 contractor.

Plumbing related cast-in-place concrete on exterior of building to be provided by this contractor in conformance with requirements of Division 3, including piping thrust restraints, pipe supports, hydrant supports, manholes, catch basins, grease traps, septic

tanks, distribution boxes, valve pits, meter pits, cleanout cover pads, and yard hydrant pads.

C.6 Cutting and Patching
Cutting and patching shall be the responsibility of the plumbing contractor.

C.7 Building Access
Arrange for necessary openings in building to allow for admittance or removal of all apparatus.

When building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after apparatus has been brought into building.

C.8 Equipment Access
Install piping, conduit, and accessories to permit access to equipment for maintenance. Coordinate exact location of wall and ceiling access panels and doors with general contractor, making sure that access is available for all equipment and specialties.

Where access is required in plaster walls or ceilings, furnish access doors to general contractor.

C.9 Coordination
Coordinate 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 installing contractor's expense.

Verify that devices are compatible for type of construction and surfaces on which they will be used.

C.10 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 shall be used.

Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of 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 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 12 inches 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 system identification and valve sequence number.

Valve tags are not required at a terminal device unless valves are greater than ten feet from device, located in another room, or not visible from device.

Provide a typewritten valve schedule and pipe identification schedule indicating valve number and equipment or areas supplied by each valve and 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.

C.11 Lubrication

Lubricate bearings with lubricant as recommended by manufacturer before equipment is operated for any reason.

Once equipment has been operated, maintain lubrication in accordance to manufacturer's instructions until owner accepts work.

Maintain a log of lubricants used and frequency of lubrication; include this information in Operation and Maintenance Manuals at completion of project.

C.12 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 piping floor penetrations, fire rated and non-fire rated, top of sleeve shall extend one-inch above 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 pipe penetrating sleeve is supported by a pipe clamp resting on sleeve, weld a collar or struts to sleeve that will transfer weight to existing floor structure.

For floor penetrations through existing floors in mechanical and wet locations listed below, core drill opening and provide a "Link Seal" as manufactured by the Thunderline Corporation. "Link Seal" shall consist of ASTM D2000 EPDM rubber compound interlocking links, Devlin pressure plates, and corrosion resistant fastener to prevent water from entering the penetration or core drill sleeve openings large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting non-shrink grout and cement.

Wet locations include:

Sanitary pumping stations

For pipe penetrations through existing floors in food service areas, core drill sleeve opening large enough to insert Schedule 40 sleeve and grout area around sleeve with hydraulic setting non-shrink grout/cement.

Size sleeve to allow insulated pipe to pass through sleeve and paint 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.

C.13 Sealing and Firestopping

Fire And Smoke Rated Penetrations

a. Install approved product in accordance to manufacturer's instructions where a pipe penetrates a fire/smoke rated surface.
b. When pipe is insulated, use a product which maintains integrity of insulation and vapor barrier.
c. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming.
d. Firestop mortar alone is not adequate to support substantial weight.

Non-Rated Partitions

a. In exterior wall openings below grade, assemble rubber links of mechanical seal to proper size for pipe and tighten in place, in accordance to manufacturer's instructions.
b. At interior partitions and exterior walls, pipe penetrations are required to be sealed.
c. Apply sealant to both sides of penetration in such a manner that annular space between pipe sleeve or cored opening and pipe or insulation is completely blocked.

61. Pipes and Tubes for Plumbing Piping and Equipment, Section 22 05 03.

A Description

A.1 Summary

Section Includes:

a. Pipe and pipe fittings for the following systems:
b. Domestic water piping, within 5 feet of building.
c. Sanitary sewer piping, within 5 feet of building.
d. Chemical resistant sewer piping.
e. Storm water piping, within 5 feet of building.
f. Equipment drains and over flows.
g. Unions and flanges.
h. Underground pipe markers.
i. Bedding and cover materials.

Related Sections:

a. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
b. Product requirements for firestopping for placement by Section 22 05 00.
c. Product and execution requirements for painting specified by Section 22 05 00.
d. Section 22 05 23 – Valves for Plumbing Piping: Product requirements for valves for placement by this section.
e. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.

A.2 References

American Society of Mechanical Engineers (ASME):
ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3 - Malleable Iron Threaded Fittings
ASME B16.4 - Gray Iron Threaded Fittings
ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV)
ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes

ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B31.9 - Building Services Piping
ASME B36.10M - Welded and Seamless Wrought Steel Pipe
ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications
ASTM International (ASTM):
ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings
ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM A536 - Standard Specification for Ductile Iron Castings
ASTM B32 - Standard Specification for Solder Metal
ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B75 - Standard Specification for Seamless Copper Tube
ASTM B88 - Standard Specification for Seamless Copper Water Tube
ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube
ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes
ASTM B306 - Standard Specification for Copper Drainage Tube (DWV)
ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters
ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe
ASTM D2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe
ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe

ASTM D3840 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications
ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F441 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F442 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core
ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/ Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe
ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe
ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications

American Welding Society: (AWS)
AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding
AWS D1.1 - Structural Welding Code - Steel

American Water Works Association: (AWWA)
AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution
AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service

AWWA C950 - Fiberglass Pressure Pipe

Cast Iron Soil Pipe Institute: (CISPI)

a. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
b. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

National Fire Protection Association: (NFPA)
NFPA 99 – Standard for Health Care Facilities.

A.3 Submittals
Section 22 05 00 – Basic Plumbing Materials and Methods: Submittal Procedures.

Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used.

Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

A.4 Quality Assurance
Perform work in accordance to ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

A.5 Qualifications
Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

Installer: Company specializing in performing work of this section with minimum five years' documented experience.

A.6 Pre-Installation Meetings
Convene minimum one week prior to commencing work of this section.

A.7 Delivery, Storage and Handling
Requirements for transporting, handling, storing, and protecting products. Coordinated with general contractor.

Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

Protect piping from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

A.8 Environmental Requirements
Environmental conditions affecting products on site. Coordinate with general contractor.

Do not install underground piping when bedding is wet or frozen.

A.9 Field Measurements
Verify field measurements prior to fabrication.

A.10 Coordination
Requirements for coordination shall be made by general contractor.
Coordinate installation of buried piping with trenching.

B Materials
B.1 Domestic Water Piping, Buried Within 5 Feet of Building
Copper Tubing: ASTM B88, Type K, annealed.
Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B.2 Domestic Water Piping, Above Grade
Copper Tubing: ASTM B88, Type L, drawn.
Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free.

B.3 Sanitary Sewer Piping, Above Grade
PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material.
Fittings: ASTM D2729, PVC.
Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
Fittings: ASTM D2665, PVC.
Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

PVC Pipe: ASTM D1785 Schedule 40 or ASTM D2241 SDR-26 for not less than 150 psi pressure rating, polyvinyl chloride (PVC) material.
Fittings: ASTM D2466, Schedule 40, PVC.
Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

B.4 Storm Water Piping, Buried Within 5 Feet of Building
PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.

Fittings: PVC, ASTM D2729.
Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
Fittings: PVC, ASTM D2665 or ASTM D3034.
Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679, polyvinyl chloride (PVC) material.
Fittings: PVC, ASTM D2665, ASTM D3034, or ASTM F679.
Joints: ASTM F477, elastomeric gaskets.

B.5 Storm Water Piping, Above Grade
PVC Pipe: ASTM D2665 or ASTM D3034, SDR 26, polyvinyl chloride (PVC) material.
Fittings: PVC, ASTM D2665 or ASTM D3034.
Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

B.6 Equipment Drains and Overflows
PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
Fittings: ASTM D2466, Schedule 40, PVC, [ASTM D2464 PVC, threaded.
Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

B.7 Unions and Flanges
Unions for Pipe 2 inches and Smaller:
Ferrous Piping: Class 150, malleable iron, threaded.
Copper Piping: Class 150, bronze unions with brazed joints.
Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
PVC Piping: PVC.
CPVC Piping: CPVC.

Flanges for Pipe 2-1/2 inches and Larger:
Ferrous Piping: Class 150, forged steel, slip-on flanges.
Copper Piping: Class 150, slip-on bronze flanges.
PVC Piping: PVC flanges.
CPVC Piping: CPVC flanges.
Gaskets: 1/16 inch thick preformed neoprene gaskets.

PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

B.8 Underground Pipe Markers
Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

C Construction

C.1 Examination

Verification of existing conditions before starting work shall be coordinated with general contractors requirements.

Verify excavations are to required grade, dry, and not over-excavated.

Verify trenches are ready to receive piping.

C.2 Preparation

Ream pipe and tube ends. Remove burrs.

Remove scale and dirt on inside and outside before assembly.

Prepare piping connections to equipment with flanges or unions.

Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

C.3 Installation – Buried Piping Systems

Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

Establish elevations of buried piping with not less than 4 feet of cover.

Excavate pipe trench in accordance to civil contractor and general contractor.

Install pipe to elevation as indicated on Drawings.

Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches loose depth; compact to 95 percent modified density.

Install pipe on prepared bedding.

Route pipe in straight line.

Install pipe to allow for expansion and contraction without stressing pipe or joints.

Install plastic ribbon tape continuous over top of pipe.

C.4 Installation – Above Ground Pipe

Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

Group piping whenever practical at common elevations.

Sleeve pipe passing through partitions, walls and floors.

Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

Provide access where valves and fittings are not accessible.

Install non-conducting dielectric connections wherever jointing dissimilar metals.

Establish invert elevations, slopes for drainage to 1/8 inch per foot. Maintain gradients.

Slope piping and arrange systems to drain at low points.

Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

Install valves in accordance to Section 22 05 23 – Valves for Plumbing Piping

Insulate piping. Refer to Section 22 07 00 – Plumbing Insulation.

Install pipe identification in accordance to Section 22 05 53 – Identification for Plumbing Piping and Equipment.

C.5 Installation – Domestic Water Piping Systems
Install domestic water piping system in accordance to ASME B31.9.

C.6 Installation – Sanitary Waste and Vent Piping Systems
Install sanitary waste and vent piping systems in accordance to ASME B31.9.

Install bell and spigot pipe with bell end upstream.

Support cast iron drainage piping at every joint.

C.7 – Installation – Storm Drainage Piping Systems
Install storm drainage piping systems in accordance to Section 22 14 00 – Facility Storm Drainage.

Install bell and spigot pipe with bell end upstream.

Support cast iron drainage piping at every joint.

C.8 Field Quality Control
Field inspecting, testing, adjusting, and balancing shall conform to Wisconsin Plumbing Code.

Test domestic water piping system in accordance to applicable code and local authority having jurisdiction.

Test sanitary waste and vent piping system in accordance to applicable code and local authority having jurisdiction.

Test storm drainage piping system in accordance to applicable code and local authority having jurisdiction.

C.9 Cleaning
Flush lines before placing into service.

62. Motor Requirements for Plumbing Equipment, Section 22 05 13.

A Description
A.1 Summary
Section Includes:
Single and three phase motors.

Related Sections:
a. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
b. Section 22 30 00 - Plumbing Equipment: Equipment requiring motors.
c. Division 26 - Electrical - Electrical for power wiring, starters, and other electrical devices.

A.2 References
American Bearing Manufacturers Association: (ABMA)
a. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings

Institute of Electrical and Electronic Engineers: (IEEE)
a. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.

National electrical Manufacturers Association: (NEMA)
NEMA MG-1 – Motors and Generators.

National Fire Protection Association: (NFPA)
a. NFPA 70 - National Electrical Code.

A.3 Submittals
Section 22 05 00 – Submittal Procedures: Requirements for submittals.

Submit with equipment which 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.

Submit manufacturer's instructions in manuals with specific equipment to which they apply.

A.4 Electrical Coordination
Starters, disconnects, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for control of motors or electrical equipment are provided by contractor, except as specifically noted elsewhere in this division of specifications.

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 owner's representative of such discrepancy.

Costs involved in any changes required due to equipment substitutions initiated by contractor shall be responsibility of contractor.

A.5 Product Criteria
Motors to conform to all applicable requirements of NEMA, IEEE, and NEC standards and shall be listed by U.L. for service specified.

Select motors for conditions in which they will be required to perform; i.e., general purpose, splash-proof, explosion-proof, standard duty, high torque, or any other special type as required by equipment or motor manufacturer's recommendations.

Furnish motors for starting in accordance to utility requirements and compatible with starters as specified.

B Materials
B.1 General
Work shall conform to requirements of Division 26 - Electrical.

Power wiring shall be provided by electrical contractor. Control wiring shall be provided by the plumbing contractor.

Plumbing contractor shall provide wiring diagrams for use by the electrical contractor.

B.2 Motors
Motors smaller than 1/2 HP shall be NEMA standard motors rated for 120 volts, AC, single phase, 60 Hz.

Motors shall be capacitor start and capacitor run type and shall have internal overload protection.

Motors 1/2 HP and larger shall be NEMA standard motors rated for specified voltage, AC, three phase and 60 Hz.

Motors shall be Design B, squirrel cage, open drip-proof construction with standard T frame, ball bearings, Class B insulation, single winding, continuous duly rated and 1.15 service factor, unless noted otherwise.

Minimum power factor for motors one HP and larger is 85 percent at rated capacity. Capacitors for power factor correction are not acceptable.

Provide devices for motor overload protection unless integral with equipment.

Devices shall be sized according to actual measured current draw with motor operating under normal load conditions.

Provide temporary protective devices where installation is not complete.

B.3 Motor Starters
Motor starters shall be provided by plumbing contractor.

Provide a combination starter for each motor.

Starter shall conform to Allen-Bradley Company Bulletin 512, consisting of a Bulletin 509 full voltage starter and non-fusible disconnect switch mounted in a NEMA Type 1 general purpose enclosure.

Starter shall be equipped as standard with block type overload relays and external reset buttons.

Starter shall be equipped as standard with a transformer to provide a 120V, 60 Hz, secondary control circuit.

Provide a three position Hand-Off-Auto selector switch for field installation in the enclosure flange: Allen-Bradley Catalog No. 1481-N51A or 1481-N51B.

B.4 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 manufacturer of equipment on which 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 equipment sections.

Use grease lubricated anti-friction ball bearings with housings equipped with plugged/capped provision for re-lubrication, rated for minimum ABMA 9, L-10 life of 20,000 hours.

Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

Open drip-proof motors to have a 1.15 service factor. Other motor types may have minimum 1.0 service factors.

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 values listed below when tested in accordance to NEMA MG 1.

B.5 Motors Used on Variable Frequency Drives
Motors must be suitable for use with drive specified, including but not limited to motor cooling.

C Construction
C.1 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 driven device, mount coupling to shafts in accordance to coupling manufacturer's recommendations.

Using a dial indicator, check angular misalignment of two shafts; adjust motor position as necessary so that angular misalignment of shafts does not exceed 0.002 inches per inch diameter of coupling hub. Again using dial indicator, check shaft for run-out to assure concentricity of shafts; adjust as necessary so that run-out does not exceed 0.002 inch.

When motor will be connected to driven device by means of a belt drive, mount sheaves on appropriate shafts in accordance to manufacturer's instructions.

Use a straight edge to check alignment of sheaves; reposition sheaves as necessary so that straight edge contacts both sheave faces squarely.

After sheaves are aligned, loosen adjustable motor base so that belt(s) can be added and tighten base so that belt tension is in accordance to drive manufacturer's recommendations.

Frequently re-check belt tension and adjust if necessary during first day of operation and again after several days.

Verify proper rotation of each three-phase motor as it is being wired or before motor is energized for any reason.

Lubricate all motors requiring lubrication. Record lubrication material used and frequency of use. Include this in maintenance manuals.

63. Plumbing Specialties, Section 22 05 14.

A Description
A.1 Summary
Section Includes:

a. Cleanouts.
b. Miscellaneous plumbing specialties.

Related Sections:

a. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
b. Section 22 05 23 - Valves for Plumbing Piping.
c. Section 22 14 00 - Facility Storm Drainage.

A.2 References
American Society of Mechanical Engineers: (ASME)

a. ASME A112.14.1 - Backwater Valves
b. ASME A112.21.1M – Floor Drains.
c. ASME A112.21.2M - Roof Drains.

American Society of Safety Engineers: (ASSE)

a. ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.
b. ASSE 1010 - Water Hammer Arrestors.
c. ASSE 1011 - Hose Connection Vacuum Breakers.
d. ASSE 1012 - Backflow Preventers with Intermediate Atmospheric Vent.
e. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
f. ASSE 1018 - Trap Seal Primer Valves.
g. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

ASTM International: (ASTM)

a. ASTM A48 – Specification for Gray Iron Castings.
b. ASTM A443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
c. ASTM A478 - Specification for Precast Reinforced Concrete Manhole Sections.
d. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
e. ASTM C990 - Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

Plumbing and Drainage Institute: (PDI)

a. PDI-WH-201 - Water Hammer Arrestors.

A.3 Submittals

Section 22 05 00 – Submittal Procedures: Requirements for submittals.

Shop Drawings: Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, and manufacturer's performance limitations.

Submit manufacturer's installation requirements.

A.4 Quality Assurance

Plumbing products requiring approval by State and local authorities must be approved at time of shop drawing submission.

B Materials

B.1 Cleanouts

Manufacturers:
Josam Company.
Jay R. Smith Manufacturing Company.
Tyler Pipe/Wade Division.
Watts Water Technologies.
Zurn Plumbing Products.
Or approved equal.

Reference Plumbing Drain and Cleanout Schedule on Drawings.

C Construction

C.1 Installation – General

Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance to manufacturers recommendations.

Set cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18-inch 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.

64. Valves for Plumbing Piping, Section 22 05 23.

A Description

A.1 Summary

Section Includes:

a. Waste System Valves.
b. Specialty Valves and Valve Accessories.

Related Sections:

a. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
b. Section 22 05 14 - Plumbing Specialties.
c. Section 22 30 00 - Plumbing Equipment.

A.2 References

American National Standards Institute (ANSI)

a. ANSI Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

American Society of Safety Engineers (ASSE)

a. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

American Water Works Association (AWWA)

a. AWWA C504 – Rubber-Seated Butterfly Valves.
b. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
c. AWWA C550 – Protective Epoxy Interior Coatings for Valves and Hydrants.
d. AWWA C800 - Underground Service Line Valves and Fittings.

ASTM International

a. ASTM D4101 - Specification for Polypropylene Injection and Extrusion Materials.

A.2 Submittals

Section 22 05 00 – Submittal Procedures: Requirements for submittals.

Submit schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on project. Temperature ratings specified are for continuous operation.

A.3 Design Criteria

Where valve types are specified for individual plumbing services, each valve type shall be of same approved manufacturer unless prior written approval is obtained from owner's representative.

Valves to be line size unless specifically noted otherwise.

B Materials

B.1 Waste System Valves

Gate Valves: 2-Inch and Smaller: Bronze body, bronze trim, threaded ends, solid wedge, rising stem, union bonnet, malleable iron hand wheel, suitable for 300 psi WOG. Manufacturers:

Crane 431UB
Hammond IB629
Lunkenheimer 3151
Milwaukee 1151(M)
NIBCO T134
Powell 2714
Stockham B120
Or approved equal.

Swing Check Valves: 1-1/2-Inch and Smaller: Bronze body, threaded ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward.
Manufacturers:
Crane 1342
Hammond IB941
Nibco S413B
Watts CVYS
Or approved equal.

C Construction
C.1 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 allowing access for operation, servicing, and replacement.

Provide valve handle extensions for all valves installed in insulated piping.

Install valves with stem in upright or horizontal position. Install butterfly valves with stem in horizontal position.

Valves installed with stems down will not be accepted.

Prior to flushing of piping systems, place valves in full-open position.

C.2 Shut Off Valves
Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair, as indicated on drawings.

C.3 Swing Check Valves
Install swing check valves in re-circulation branch lines and as indicated on drawings.

Provide weighted swing check valves at sanitary sump pump discharges.

65. Hangers and Supports for Plumbing, Section 22 05 29.

A Description
A.1 Summary
Section Includes:
Supports of plumbing equipment and materials.
Piping system anchors.

Related Sections:

a. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
b. Section 22 07 00 - Plumbing Insulation: Insulation protection at support devices.

A.2 References
ASTM International: (ASTM)

a. ASTM A123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
b. ASTM B633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
c. ASTM B695 - Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

Manufacturers Standardization Society: (MSS)

a. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.
b. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

A.3 Quality Assurance
Substitution of Materials: In accordance to Section 22 05 00 – Submittal Procedures.

A.4 Description
Provide supporting devices as required for installation of mechanical equipment and materials.

Supports and installation procedures shall conform to latest requirements of ANSI Code for building piping.

Do not hang any mechanical item directly from a metal deck or run piping so it rests on bottom chord of any truss or joist.

Fasteners depending on soft lead for holding power or requiring powder actuation shall not be accepted.

Support apparatus and material under 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.

A.5 Submittals
Section 22 05 00 – Submittal Procedures - Submittal Procedures: Requirements for submittals.

Submit manufacturer's installation instructions.

A.6 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 equipment, whichever is greater.

Standard pipe hangers and supports as specified in this section are required beyond 100 pipe diameter divided by 3 for support distance.

B Materials
B.1 Manufacturers
Acceptable Manufacturers:
- Anvil
- B-Line
- Pate
- Piping Technology
- Roof Products and Systems
- Or approved equal.

B.2 Structural Supports
Provide supporting steel required for installation of mechanical equipment and materials, including angles, channels, and beams, to suspended or floor supported tanks and equipment.

Supporting steel not be specifically indicated on Drawings, shall be used as required by governing code.

B.3 Pipe Hangers and Supports
Hangers for Pipe Sizes 1/2-Inch through 2-Inch:
a. Carbon steel, adjustable swivel ring. B-Line B3170NF, Anvil 69 or 70.
b. Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

Hangers for Pipe Sizes 2-Inch and Larger:
a. Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

Wall Support:

a. Carbon steel welded bracket with hanger. B-Line 3068 Series, Anvil 194 Series.
b. Perforated, epoxy painted finish, 16-12 gauge minimum, steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe and tubing clamps.
c. B-Line type S channel with B-2000 series clamps or Anvil type PS 200 H with PS 1200 clamps.
d. When copper piping is being supported, provide flexible elastomeric and thermoplastic isolation cushion material to completely encircle piping and avoid contact with 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: Supports, fasteners and clamps directly connected to copper piping shall be copper plated or polyvinyl chloride coated. Where steel channels are used, provide isolation collar between supports, clamps, fasteners and copper piping.

Glass Pipe Supports: Supports and clamps directly connected to glass piping shall be fully lined with 1/4-inch neoprene padding.

B.4 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 following schedule, total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed limits indicated in following schedule.

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

B.5 Beam Clamps
MSS SP-69 Types 19 or Type 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.

B.6 Concrete Inserts
Poured In Place:

a. 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 insert to be held by concrete in compression to maximize load carrying capacity. B-Line B2505, Anvil 281.
b. 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, or Redhead.

B.7 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 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 channel inserts may be used.

Select insert length to accommodate all pipe in area.

B.8 Anchors
Use welding steel shapes, plates, and bars to secure piping to structure.

B.9 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:

a. Exterior locations.
b. Parking ramps.
c. Swimming pool equipment rooms.
d. Chemical storage and hazardous waste storage rooms.
e. Wet wells.
f. Sanitary pumping stations.
g. Food service/kitchen areas.
h. Walk-in coolers/freezers.
i. Locker rooms.
j. Greenhouses.
k. Meter pits.

C Construction

C.1 Installation

Size, apply and install supports and anchors in compliance with manufacturer's recommendations.

Install supports to provide for free expansion of piping system.

Support piping from structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands.

Fasten ceiling plates and wall brackets securely to structure and test to demonstrate adequacy of fastening.

Coordinate hanger and support installation to properly group piping of all trades.

Where piping can be conveniently grouped to allow use of trapeze type supports, use standard structural shapes or continuous insert channels for supporting steel.

Where continuous insert channels are used, pipe supporting devices made specifically for use with channels may be substituted for 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 exterior of piping insulation.

Where a vapor barrier is not required, hangers may be installed either on exterior of pipe insulation or directly on piping.

Perform welding in accordance to standards of American Welding Society.

C.2 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 same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain slope specified in piping section of these specifications.

Space hangers for pipe as follows:

Pipe Material	Maximum Pipe Size	Maximum Horizontal Spacing	Vertical 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"
Copper	3"	10'-0"	10'-0"
Copper	4" and larger	12'-0"	10'-0"
Ductile Iron	All	10'-0"	20'-0"
Glass	Per Pipe Mfr.	8'-0"	12'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-0"
Steel	8" through 12"	14'-0"	20'-0"
Steel	14" and over	20'-0"	20'-0"
Plastic	Drain and Vent	4'-0"	10'-0"
Plastic	1" or less	32"	4'-0"
Plastic	1-1/4" and over	4'-0"	6'-0"
Plastic	Pure Water or less	1-1/2" Continuous	5'-0"

C.3 Riser Clamps
Support vertical piping with clamps secured to piping and resting on building structure or secured to building structure below at each floor.

C.4 Concrete Inserts and Continuous Insert Channels
Select size based on 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 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 slab surface.

C.5 Anchors
Install where indicated on 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 accommodating both expansion and contraction of piping.

66. Identification for Plumbing Piping and Equipment, Section 22 05 53.

A Description
A.1 Summary
Section Includes:

a. Nameplates
b. Tags
c. Stencils
d. Pipe markers
e. Ceiling tacks
f. Labels
g. Lockout devices

Related Sections:

a. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.

A.2 References
American Society of Mechanical Engineers (ASME):

a. ASME A13.1 - Scheme for the Identification of Piping Systems.

National Fire Protection Association (NFPA):

a. NFPA 99 - Standard for Health Care Facilities.

A.3 Submittals
Section 22 05 00 – Submittal Procedures: Submittal procedures.

Product Data: Submit manufacturers catalog literature for each product required.

Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

Samples: Submit two tags, labels, and pipe markers, size used on project.

Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

Manufacturer's Certificate: Certify products meet or exceed specified requirements.

A.4 Closeout Submittals
Section 22 05 00 - Execution and Closeout Requirements: Closeout procedures.

Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

A.5 Quality Assurance
Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

A.6 Qualifications
Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

A.7 Pre-Installation Meetings
Conform to general contractor requirements for pre-installation meeting.

Convene minimum one week prior to commencing work of this section.

A.8 Field Measurements
Verify field measurements prior to fabrication.

A.9 Extra Materials
Provide spare parts and maintenance products.

B Materials

B.1 Namaplates

Manufacturers:

a. Craftmark Identification Systems
b. Safety Sign Co.
c. Seton Identification Products
d. Substitutions: Engineer approval

Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

B.2 Tags

Plastic Tags:

a. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

Metal Tags:

a. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

Information Tags:

a. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

Tag Chart: Typewritten letter size list of applied tags and location.

B.3 Stencils

Stencils: With clean cut symbols and letters of following size:

a. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
b. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
c. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inch high letters.

Stencil Paint: As specified in Section 22 05 00 semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

B.4 Pipe Markers

Color and Lettering: Conform to ASME A13.1.

a. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

Plastic Tape Pipe Markers:

a. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

Plastic Underground Pipe Markers:

a. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B.5 Labels

Description: Polyester, size 1.9 x 0.75 inches, adhesive backed with printed identification.

B.6 Lockout Devices

Lockout Hasps:

a. Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

Valve Lockout Devices:

Nylon device preventing access to valve operator, accepting lock shackle.

C Construction

C.1 Preparation

Degrease and clean surfaces to receive adhesive for identification materials.

Prepare surfaces in accordance to Section 22 05 00 for stencil painting.

C.2 Installation

Apply stencil painting in accordance to manufacturer's written instructions.

Install identifying devices after completion of coverings and painting.

Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

Install tags using corrosion resistant chain. Number tags consecutively by location.

Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

Install piping identification on medical gas systems. Reference Section 22 60 00 – Gas and Vacuum Systems for Lab and Health Care.

Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

Identify control panels and major control components outside panels with plastic nameplates.

Identify valves in main and branch piping with tags.

Identify piping, concealed or exposed, with plastic tape pipe markers.

Identify service, flow direction, and pressure.

Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

C.3 Schedules

Identification:

a. Forced Mains.
    i. Identification Type:
    ii. Background Size:
    iii. Background Color:
    iv. Lettering Size:
    v. Lettering Color:
b. Domestic Cold Water Piping.
    i. Identification Type:
    ii. Background Color:
    iii. Lettering Size:
    iv. Lettering Color:
c. Domestic Hot Water.
    i. Identification Type:
    ii. Background Color:
    iii. Lettering Size:
    iv. Lettering Color:

Valve Tags:

a. Forced Mains.
    i. Tag Material:
    ii. Tag Size:
    iii. Tag Shape:
    iv. Tag Color:
b. Domestic Cold Water.
    i. Tag Material:
    ii. Tag Shape:
    iii. Tag Color:

67. Facility Storm Drainage, Section 22 14 00.

A Description

A.1 Summary

Section Includes:

a. Plumbing pipe and pipe fittings.

Related Sections:

a. Section 22 05 00 – Basic Plumbing Materials and Methods.
b. Section 22 05 14 - Plumbing Specialties.
c. Section 22 05 29 - Hangers and Supports for Plumbing.

A.2 References

American Society of Mechanical Engineers: (ASME)
ASME B16.3 - Malleable Iron Threaded Fittings.
ASME B16.4 - Cast Iron Threaded Fittings.
ASME B16.5 - Pipe Flanges and Flanged Fittings.
ASME B16.22 - Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings.
ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.

American Water Works Association: (AWWA)
AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
AWWA C105- - Polyethylene Encasement for Ductile-Iron Pipe Systems.
AWWA C110 - Ductile-Iron and Gray-Iron Fittings for Water.
AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
AWWA C153 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch - 12 Inch, for Water Distribution.

ASTM International: (ASTM)
ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
ASTM A74 - Specification for Cast Iron Soil Pipe and Fittings.
ASTM A105 - Specification for Forgings, Carbon Steel, for Piping Components.
ASTM A126 - Specification for Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings.
ASTM A234 - Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
ASTM A861 - Specification for High Silicon Iron Pipe and Fittings.
ASTM A888 - Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
ASTM B32 - Specification for Solder Metal.
ASTM B88 - Specification for Seamless Copper Water Tube.

ASTM B306 - Specification for Copper Drainage Tube (DWV).
ASTM B813 - Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.
ASTM C76 - Specification for Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe.
ASTM C443 - Specification for Joints for Circular Concrete Pipe Sewer and Culvert Pipe Using Rubber Gaskets.
ASTM C564 - Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
ASTM C1540 - Specification for Heavy Duty Shielded Couplings for Joining Hubless Cast Iron Soil Pipe and Fittings.
ASTM D1785 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe.
ASTM D2321 - Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
ASTM D2241 - Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
ASTM D2464 - Specification for Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
ASTM D2466 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
ASTM D2513 - Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
ASTM D2564 - Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
ASTM D2657 - Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
ASTM D2665 - Specification for Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
ASTM D2729 - Specification for Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
ASTM D2774 - Practice for Underground Installation of Thermoplastic Pressure Piping.
ASTM D2855 - Practice for Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.
ASTM D3034 - Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
ASTM D3139 - Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
ASTM D3311 - Specification for Drain, Waste and Vent (DWV) Plastic Fitting Patterns.
ASTM D4101 - Specification for Propylene Plastic Injection and Extrusion Materials.
ASTM F405 - Specification for Corrugated Polyethylene (PE) Tubing and Fittings.
ASTM F437 - Specification for Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80.
ASTM F438 - Specification for Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40.
ASTM F441 - Specification for Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80.
ASTM F656 - Specification for Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

Cast Iron Soil Pipe Institute: (CISPI)
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.

A.3 Submittals
Section 22 05 00 - Submittal Procedures: Requirements for submittals.

Statement from manufacturer on his letterhead that pipe furnished meets ASTM, AWWA, or CISPI specification contained in this section.

A.4 Quality Assurance
Substitution of Materials: To be reviewed by engineer.

Order copper, cast iron, steel, PVC and polyethylene pipe with each length marked with name or trademark of manufacturer and type of pipe; with each shipping unit marked with purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting specification requirements must be replaced with material that meets these specifications without additional cost to owner.

A.5 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 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 contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

A.6 Design Criteria

Use only new material, free of defects, rust and scale, and meeting latest revision of ASTM, AWWA, or CISPI specifications as listed in this specification.

Construct all piping for highest pressures and temperatures in respective system.

Non-metallic piping will be acceptable only for 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, H58 drawn temper copper tubing is specified, ASTM B88, type K, H58 drawn temper copper tubing may be substituted at contractor's option.

B Materials

B.1 Storm and Clearwater Waste and Vent

Interior Above Ground:

a. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

Pressurized Interior Above Ground:

a. Type L copper water tube, H58 drawn temper, ASTM B88; with cast copper drainage fittings (DWV), ASME B16.23; wrought copper drainage fittings (DWV), ASME B16.29; lead free, less than 0.2 percent solder, ASTM B32; flux, ASTM B813.
b. Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.

Interior Below Ground 15-Inch and Smaller:

a. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

Pressurized Below Ground 3-Inch and Smaller:

a. 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.

b. Type K copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ASME B16.23; wrought copper drainage fittings (DWV), ASME B16.29; lead free (<0.2 percent) solder, ASTM B32; flux, ASTM B813.

C Construction

C.1 General

Install pipe and fittings in accordance to reference standards, manufacturers' recommendations and recognized industry practices.

C.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.

C.3 Erection

Install piping parallel to building walls and ceilings and at heights not obstructing any portion of a window, doorway, stairway, or passageway.

Where interferences develop in 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 of elastomeric pipe insulation.

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, 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 required service space for this equipment, unless piping is serving this equipment.

Install valves and piping specialties, including items furnished by others, as specified and detailed.

Provide access to valves and specialties for maintenance.

Make connections to equipment, fixtures, and systems installed by others where same requires piping services indicated in this section.

C.4 Pipe Joints

Copper Pipe Joints:

a. Remove all slivers and burrs remaining from cutting operation by reaming and filing both pipe surfaces.
b. Clean fitting and tube with metal brush, emery cloth or sandpaper.
c. Remove residue from cleaning operation, apply flux, and assemble joint to socket stop.
d. Apply flame to fitting until solder melts when placed at joint.
e. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears.
f. Wipe excess solder and flux from joint.

Threaded Pipe Joints:

a. Use a thread lubricant or teflon tape when making joints.
b. No hard setting pipe thread cement or caulking will be allowed.

Solvent Welded Pipe Joints:

a. Install in accordance to ASTM D2855.
b. Saw cut piping square and smooth.
c. 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.
d. Support and restrain pipe during cutting to prevent nicks and scratches.
e. Bevel ends 10-15 degrees and deburr interior.
f. Remove dust, drips, moisture, grease, and other superfluous materials from pipe interior and exterior.
g. Check dry fit of pipe and fittings.
h. Reject materials which are out of round or do not fit within close tolerance.
i. Use heavy body solvent cement for large diameter fittings.
j. Maintain pipe, fittings, primer, and cement between 40 and 100 degrees F during application and curing.
k. Apply primer and solvent using separate daubers (3-inch and smaller piping only) or clean natural bristle brushes about 1/2 size of pipe diameter.
l. Apply primer to fitting socket and pipe surface with a scrubbing motion.
m. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths.
n. Apply solvent cement to fitting socket and pipe in an amount greater than needed to fill any gap.
o. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to bottom of socket.
p. Solvent cement application and insertion must be completed in less than 1 minute.
q. Minimum of 2 installers is required on piping 4-inch and larger.

r. Hold joint for 30 seconds or until set.
s. Reference manufacturers' recommendations for initial set time before handling and for full curing time before pressure testing.
t. Cold weather solvent and cement may be utilized only under unusual circumstances and when specifically approved by engineer/architect.

C.5 Pipe Connections

Mechanical Hubless Pipe Connections:

a. Place gasket on end of one pipe or fitting and clamp assembly on end of other pipe or fitting.
b. Firmly seat pipe or fitting ends against integrally molded shoulder inside neoprene gasket.
c. Slide clamp assembly into position over gasket.
d. Tighten fasteners to manufacturers recommended torque.

Mechanical Joint Pipe Connections:

a. Comply with AWWA C600/C605 installation requirements.
b. Clean pipe end and socket.
c. Clean and lubricate pipe end, socket, and gasket with soapy water or gasket lubricant.
d. Place gland and gasket, properly oriented, on pipe end.
e. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight.
f. Press gland evenly against gasket, insert bolts, and hand tighten nuts.
g. Make joint deflection prior to tightening bolts.
h. Evenly tighten bolts in sequence to recommended torque.

Push-On Gasketed Pipe Connections:

a. Clean pipe end, bell, gasket seat, and gasket of dirt or debris.
b. Coat end of pipe and gasket with gasket lubricant.
c. Ensure pipe is supported off ground so lubricant does not pick up dirt.
d. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer.
e. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end.
f. Insert to fully seated position or to reference mark on pipe.

Mechanical Grooved Pipe Connections:

a. Use pipe factory grooved in accordance to coupling manufacturer's specifications or field grooved pipe in accordance to same specifications using tools specially designed for application.
b. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance to coupling manufacturer's specifications.

C.6 Mechanically Formed Tee Fittings
Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out tube surface to form a collar having a height of not less than three times thickness of tube wall.

Use an adjustable collaring device. Notch and dimple branch tube.

Braze joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

C.7 Storm and Clearwater Waste and Vent
Verify invert elevations and building elevations prior to installation.

Install exterior piping pitched to drain at indicated elevations and slope.

Install interior piping pitched to drain at minimum slope of 1/8-inch per foot where possible and in no case less than 1/16-inch per foot for piping 3-inch and larger.

Install exterior piping below predicted frost level and not less than 5-foot bury depth to top of pipe wherever possible.

Where piping is located above predicted frost level, provide frost protection in accordance to local building code requirements.

C.8 Piping System Leak Tests
Isolate or remove components not rated for test pressure from system.

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 additional pressure load under test, provide temporary restraints at fittings or expansion joints.

Backfill underground water mains prior to testing with exception of thrust restrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from piping being tested by means of air vents or loosening of flanges and unions. Measure and record test pressure at high point in system.

For air or nitrogen tests, gradually increase pressure to not more than one half of test pressure; then increase pressure in steps of approximately one-tenth of test pressure until 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 test period.

Inspect system for leaks. Where leaks occur, repair area with new materials and repeat test. Caulking will not be acceptable.

System	Medium	Test Pressure	Test Duration
Clearwater Waste and Vent	Water	10' water	2 hours
Storm and Clearwater Waste	Water	10' water	2 hours
Pressurized Storm/Clearwater Waste	Water	100 psig	2 hours

68. Plumbing Equipment, Section 22 30 00.

A Description

A.1 Summary

Section Includes:

a. Pumps.

Related Sections:

a. Section 22 05 00 – Basic Plumbing Materials and Methods.
b. Section 22 05 13 - Motor Requirements for Plumbing Equipment.
c. Section 22 05 14 - Piping Specialties.
d. Section 22 05 23 - Valves for Plumbing Piping.
e. Section 22 07 00 - Plumbing Insulation.
f. Division 26 – Electrical.

A.2 References

National Association of Corrosion Engineers: (NACE)

a. NACE No. 1 - White Metal Blast Cleaning.

Society for Protective Coatings: (SSPC)

a. SSPC SP 5 - White Metal Blast Cleaning.

A.3 Quality Assurance

Substitution of Materials: Reviewed by engineer.

Plumbing products requiring approval by State of Wisconsin Department of Commerce must be approved or have pending approval at time of shop drawing submission.

A.4 Submittals

Section 22 05 00 - Submittal Procedures: Requirements for submittals.

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.

B Materials

B.1 Sumps

Fiberglass Sump Basin:

a. Constructed of 25-30 percent fiberglass and 70-75 percent polyester resin with no fillers.
b. Minimum design safety factor of four.
c. Complete with tapped top flange.
d. Side hub fittings.
e. Bolted galvanized steel, aluminum or fiber glass 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
Max. 15' Depth	1/4	5/16	5/16	5/16	3/8	3/8	7/16
Max. 20' Depth	5/16	5/16	3/8	3/8	7/16	1/2	1/2

Precast Reinforced Concrete Manhole Sections: ASTM C478;

a. Construct base of 6-inch thick precast reinforced concrete or 8-inch thick cast in place concrete.
b. Construct top of precast reinforced concrete or 6-inch thick reinforced concrete slab.
c. Seal between sections with rubber ring gaskets, ASTM C443, or preformed flexible gasket material, ASTM C990.
d. Seal pipe penetrations with flexible watertight rubber gasketed seals, ASTM C923.
e. 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.

B.2 Sump Pumps

Manufacturer:

ITT Goulds Pumps
Little Giant Pump Company
PACO Pumps
Pentair, Inc., Aurora Pumps
Pentair, Inc., Hydromatic Pumps
Pentair, Inc., Myers Pumps
Pentair, Inc., Sta-Rite Pumps
Stancor, Inc.

Weil Pump Company, Inc.
Zoeller Pump Company
Substitutions: Reviewed by engineer.

Type: Submersible pumps constructed of epoxy coated cast iron shell, cast iron volute, two vane enclosed 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:

a. Single On/Off float switch, UL listed.
b. Double (one On, one Off) float switch, UL listed.
c. Triple (1st pump On, 2nd pump on, both pumps Off) float switch, UL listed.
d. Four (1st pump On, 2nd pump on, both pumps Off, high level alarm) float switches, UL listed.
e. NEMA 1 indoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
f. NEMA 4X outdoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
g. Combination magnetic starter with fused disconnect switch, HOA switch, run light, resettable overload heaters, NEMA 4, UL listed.
h. 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 4.
i. 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 4.

Accessories:

a. 20-foot power cord.
b. NEMA 4 junction box.
c. Discharge check valve, full-port ball valve, and union for each pump.
d. Dual mechanical seals, seal leak detector probe, and warning light in control panel.
e. 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.

C Construction

C.1 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 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.

Startup and test equipment adjusting operating and safety controls for proper operation.

Lubricate pumps before startup. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.

69. Mechanical Work, Item SPV.0105.38.

A Description

This general provision describes all mechanical work as shown on the plans, provided in the contract and as described in the applicable sections of the following general articles:

a. Basic HVAC Requirements Section 23 05 00
b. Hangers and Supports for HVAC Piping and Equipment, Section 23 05 29
c. Vibration and Seismic Controls for HVAC Piping Equipment Section 23 05 48
d. Electric Instrumentation and Control Devices for HVAC Section 23 09 14
e. HVAC Ducts and Casings Section 23 31 00
f. Air Duct Accessories Section 23 33 00
g. HVAC Fans Section 23 34 00
h. Diffusers, Registers and Grilles Section 23 37 10
i. Split System Air Conditioning Units Section 23 81 28
j. Electric Heating Terminal Units Section 23 82 01
k. Packaged Terminal Air Conditioning Units, Section 23 81 13

B Materials

All materials shall conform to the applicable sections of the following general articles:

a. Basic HVAC Requirements Section 23 05 00
b. Hangers and Supports for HVAC Piping and Equipment, Section 23 05 29
c. Vibration and Seismic Controls for HVAC Piping Equipment Section 23 05 48
d. Electric Instrumentation and Control Devices for HVAC Section 23 09 14
e. HVAC Ducts and Casings Section 23 31 00
f. Air Duct Accessories Section 23 33 00

g. HVAC Fans Section 23 34 00
h. Diffusers, Registers and Grilles Section 23 37 10
i. Split System Air Conditioning Units Section 23 81 28
j. Electric Heating Terminal Units Section 23 82 01
k. Packaged Terminal Air Conditioning Units, Section 23 81 13

C Construction

All construction shall conform to the applicable sections of the following general articles:

a. Basic HVAC Requirements Section 23 05 00
b. Hangers and Supports for HVAC Piping and Equipment, Section 23 05 29
c. Vibration and Seismic Controls for HVAC Piping Equipment Section 23 05 48
d. Electric Instrumentation and Control Devices for HVAC Section 23 09 14
e. HVAC Ducts and Casings Section 23 31 00
f. Air Duct Accessories Section 23 33 00
g. HVAC Fans Section 23 34 00
h. Diffusers, Registers and Grilles Section 23 37 10
i. Split System Air Conditioning Units Section 23 81 28
j. Electric Heating Terminal Units Section 23 82 01
k. Packaged Terminal Air Conditioning Units, Section 23 81 13

D Measurement

The department will measure Mechanical Work as a single lump sum unit of work for all electrical 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.0105.38	Mechanical Work	LF

Payment is full compensation for furnishing and installing all electrical work as per the plans, details, and the following general articles: Basic HVAC Requirements Section 23 05 00, Hangers and Supports for HVAC Piping and Equipment, Section 23 05 29, Vibration and Seismic Controls for HVAC Piping Equipment Section 23 05 48, Electric Instrumentation and Control Devices for HVAC Section 23 09 14, HVAC Ducts and Casings Section 23 31 00, Air Duct Accessories Section 23 33 00, HVAC Fans Section 23 34 00, Diffusers, Registers and Grilles Section 23 37 10, Split System Air Conditioning Units Section 23 81 28, Electric Heating Terminal Units Section 23 82 01, Packaged Terminal Air Conditioning Units, Section 23 81 13; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

70. Basic HVAC Requirements, Section 23 05 00.

A Description

A.1 Summary

Section Includes:

a. Reference Standards
b. References
c. Regulatory Requirements
d. Quality Assurance
e. Drawings
f. Continuity of Existing Services
g. Protection of Products and Finished Surfaces
h. Sleeves and Openings
i. Sealing and Firestopping
j. Product Substitution Procedures
k. Submittals
l. Off Site Storage
m. Request and Certification for Payment
n. Certificates and Inspections
o. Operating and Maintenance Instructions
p. Training of Owner Personnel
q. Record Drawings
r. Manufacturer's Field Services and Reports
s. Access Panels and Doors
t. Identification
u. Demolition
v. Cutting and Patching
w. Building Access
x. Equipment Access
y. Coordination
z. Lubrication

Related Sections:

Applicable provisions of Division 01 shall govern all work under this Section.

a. Section 23 05 13 - Motor Requirements for HVAC Equipment.
b. Section 23 33 00 - Air Duct Accessories.

A.2 Reference Standards

Abbreviations of standards organizations referenced in other sections are as follows:
AABC - Associated Air Balance Council.
ADC - Air Diffusion Council
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
AWS - American Welding Society.
EPA - Environmental Protection Agency
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.

A.3 References

ASTM International

a. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
b. ASTM E814 - Test Method for Fire Tests of Through-Penetration Fire Stops.

Underwriters Laboratories, Inc. (UL)

a. UL 1479 - Fire Tests of Through-Penetration Firestops.
b. UL 723 - Surface Burning Characteristics of Building Materials.

A.4 Regulatory Requirements

Specified systems shall be installed in compliance with federal, state and local codes and regulations.

Contractor shall secure and pay for permits, licenses and certificates of inspection applicable to this work.

Contractor shall pay taxes applicable to this work.

A.5 Quality Assurance

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated in the contract documents, contractor is responsible for all costs involved in integrating equipment or accessories into system and for obtaining performance from system into which these items are placed.

This may include changes found necessary during testing, adjusting, and balancing phase of project.

A.6 Drawings
The drawings show the general arrangement of piping, equipment and appurtenances and shall be followed as close as possible the actual building construction and work of other contractors.

Work shall conform to requirements indicated on drawings. Architectural and structural drawings shall take precedence.

Due to the scale of the drawings, it is not possible to indicate all offsets, fittings and accessories that may be required.

Investigate architectural and structural conditions affecting work and arrange work accordingly, providing offsets, fittings and accessories as may be required to meet constructed design.

HVAC equipment and systems, including piping and ductwork shall also be installed to maintain required operation and maintenance clearances.

Work shall conform to requirements indicated on the Drawings.

A.7 Continuity of Existing Services
Do not interrupt or change existing services without prior written approval from engineer/architect.

When interruption is required, coordinate down-time with owner to minimize disruption to his activities.

Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

A.8 Protection of Products and Finished Surfaces
Furnish one can of touch-up paint for each different color factory finish which is to be final finished surface of product.

Deliver touch-up paint with other "loose and detachable parts" to owner as specified.

Transport and handle products in accordance to manufacturer’s instruction.

Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

Store and protect products in accordance to manufacturer’s instructions.

Store with seals and labels intact and legible.

Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

For exterior storage of fabricated products, place on sloped supports above ground.

Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

Structural mechanical iron, iron pipe supports, platforms, and any equipment which is not furnished with an enamel prime coat finish and furnished under this section of work, shall be wire brushed free of rust and scale and given two coats of brown colored rust-proof paint applied by this division of work.

Any surfaces of existing or new equipment, in areas of work where finish has been used or destroyed, shall be refinished to match original finish.

A.9 Sleeves and Openings

Sleeve Requirements:

a. Provide steel pipe for sleeves penetrating floors.
b. Set sleeves two inches above floor of equipment rooms and caulk tight so water leakage cannot occur between sleeves and floors.
c. Furnish each sleeve having an inside diameter one inch larger than outside diameter of each uncovered pipe and one inch larger than outside diameter of covering for each covered pipe.
d. Pack void between sleeve and pipe or insulate with fire retardant insulation and caulking.
e. Provide 18 gage galvanized sleeves for ducts passing through walls of concrete or masonry, and critical walls of other types of construction.
f. For ducts through floor construction of equipment rooms, extend sleeve two inches above floor and finish off with 2-inch x 2-inch angles and caulk tight so water leakage cannot occur between sleeves and floor.
g. Sleeves for ductwork shall be one inch larger than outside duct dimensions and of sufficient length to pass through entire floor, wall or roof construction including finish.
h. Pack void between sleeves and duct or insulation with fire retardant insulation and caulking.

Curb and Base Requirements:

a. Contractor shall provide concrete bases, footing, piers, platforms, and curbs for equipment as required or as indicated on drawings or identified in specification sections.

b. Contractor shall be responsible for location, size and any changes required by substitution of equipment.
c. Provide alignment, foundation template drawings, anchor bolts and Embeco non-shrink grouting for bases in accordance to manufacturer's instructions.
d. Rigging and Setting of Curbs:
e. Contractor shall rig unit curbs and set counter-flashing of curbs.
f. Curbs shall be set and shimmed level.

A.10 Sealing and Firestopping

Sealing and firestopping of sleeves/openings between ductwork, piping, and sleeves, structural or partition opening shall be responsibility of contractor whose work penetrates an opening.

The responsible contractor shall hire individuals skilled in such work, such as sealing and fireproofing. These individuals hired shall normally and routinely be employed in sealing and fireproofing occupation.

A.11 Product Substitution Procedures

Engineer will consider requests for Substitutions only within 15 days after date of owner-contractor agreement.

Substitutions may be considered when a product becomes unavailable through no fault of contractor.

Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

A request constitutes a representation that contractor:

a. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
b. Will provide same warranty for Substitution as for specified product.
c. Will coordinate installation and make changes to other work that may be required for work to be complete with no additional cost to owner.
d. Waives claims for additional costs or time extension that may subsequently become apparent.
e. Will reimburse owner and engineer for review or redesign services associated with re-approval by authorities having jurisdiction.

Substitutions will not be considered when they are indicated or implied on shop drawing or Product Data submittals, without separate written request, or when acceptance will require revision to contract documents.

Substitution Submittal Procedure:

a. Submit three copies of request for substitution for consideration. Limit each request to one proposed Substitution.

b. Submit shop drawings, product data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
c. Engineer will notify contractor in writing of decision to accept or reject request.

Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.

A.12 Submittals
Division 01 - Submittal Procedures: Requirements for submittals.

Submit for equipment and systems as indicated in 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 sontract documents.

Before submitting electrically powered equipment, verify that electrical power and control requirements for equipment are in agreement with motor starter schedule on electrical drawings.

Contractor shall include a statement on shop drawing transmittal to engineer/architect that equipment submitted and motor starter schedule are in agreement or indicate any discrepancies.

Include wiring diagrams of electrically powered equipment.

Submit sufficient quantities of shop drawings to allow the following distribution:
a. Operating and Maintenance Manuals: Three copies.
b. Testing, Adjusting and Balancing Contractor: One copy.
c. Engineer/architect: One copy each.
d. Contractor and Manufacturer: As required.

Shop Drawings Submittal Procedures:
a. Shop drawings shall include detailed dimensions, capacities, gauges, arrangement and operating clearances.
b. Incomplete submittals shall not be reviewed and contractor will be held responsible for correction of work not having final approval.
c. Engineer will review or take other appropriate action on contractor submittals, such as certified shop drawings, product data, samples and other data, which contractor is required to submit, but only for limited purpose of checking for conformance with design concept and contract documents.
d. This review shall not include review of accuracy or completeness of details, such as quantities, dimensions, capacities, weights or gauges, fabrication processes, construction means or methods, coordination of work with other trades or construction safety precautions, all of which are sole responsibility of contractor.

e. Engineer's review will be conducted with reasonable promptness while allowing sufficient time in engineer's judgment to permit adequate review.
f. Review of specific items shall not indicate that engineer has reviewed entire assembly of which said item is a component.
g. Engineer will not be responsible for any deviations from contract documents not submitted to engineer in writing by contractor.
h. Engineer will not be required to review partial submissions or those for which submissions of correlated items have not been received.
i. Review of certified drawings does not relieve contractor of responsibility of furnishing and installing all system components, as per drawings and specifications for proper system operation with particular respect to BTU outputs, water and air flow capacities, minimum noise requirements and space limitations, nor from responsibility for errors or omissions of any sort in submittal drawings.
j. Engineer assumes no responsibility for contractor calculated dimensions or exact quantities of materials on shop drawings.
k. Review by engineer is subject to limitations of general conditions of the contract for construction.
l. Contractor shall thoroughly check all shop drawings prepared by subcontractors for materials or equipment suppliers with regard to measurements, size of members, materials and details to satisfy specifications and drawings.
m. Each drawing shall have a date of approval and signature of contractor's reviewer.
n. If contractor's shop drawings have been submitted and reviewed by engineer for a particular product and engineer has stamped "rejected", "revised and resubmit" or "submit specified items" after two reviews, any further review by engineer for that particular product will require contractor to compensate engineer for time spent for further review of that product at a rate of one hundred fifty dollars ($150.00) per hour.
o. Furnish approved and corrected shop drawings to all other contractors whose work is affected.

Not more than two weeks after award of contract, but before any Shop Drawings are submitted, contractor shall submit the following piping system data sheet for each piping service on project.

Item	Pipe Size (Inches)	List each piping service
Pipe	2 and smaller	Refrigerant Condensate Drain
Fittings	2 and smaller	
Nipples		
Insulation by pipe size (Type and thickness)	less than 1-1/4 1-1/4 - 2	
Hangers	Type, mfr and figure no.	
Hanger accessories		
Pipe identification		
List of specialties and accessories:		

A.13 Off Site Storage
Prior approval by engineer/architect is required.

Ductwork and metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for off site storage.

For pipe material that can be stored off site, no material will be accepted for off-site storage unless Shop Drawings for that material have been approved.

Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

A.14 Certificates and Inspections
Obtain and pay for Authorities Having Jurisdiction required inspections except those provided by Construction Manager in accordance to governing building code.

Deliver originals of these certificates to Construction Manager.

Include copies of certificates in Operating and Maintenance Manuals.

A.15 Operating and Maintenance Manuals
Contractor shall submit to engineer for review three bound copies of typewritten instructions covering complete maintenance and operation of the system.

Assemble material in three-ring or post binders, using an index at front of each volume and tabs for each system or type of equipment. In addition to data indicated in General Requirements, include following information:

a. Copies of all approved shop drawings.
b. Manufacturer's wiring diagrams for electrically powered equipment.
c. Records of tests performed to certify compliance with system requirements.
d. Certificates of inspection by regulatory agencies.
e. Temperature control record drawings and control sequences.
f. Parts lists for manufactured equipment.
g. Valve schedules.
h. Lubrication instructions, including list/frequency of lubrication done during construction.
i. Warranties.
j. Testing, adjusting and balancing data.
k. Additional information as indicated in technical specification sections.

Maintenance instructions shall include manufacturer’s literature on system major equipment components.

Maintenance instructions shall be explicit concerning time intervals for servicing and preventative maintenance, type and grades of oil and grease, packing materials, normal and abnormal clearances, cleaning, methods of equipment adjustments and complete description and list of replacement parts and materials for wearing items.

Operation instructions shall include detailed step-by-step startup and shutdown procedures, normal operating ranges such as temperatures and pressures and yearly system changeover procedure.

A.16 Training of Owner Personnel

Instruct owner's personnel in proper operation and maintenance of systems and equipment provided as part of this project.

Include not less than 4 hours of instruction, over a total of 1 training session, using Operating and Maintenance manuals during this instruction.

Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

Coordinate with owner at least two weeks prior to scheduling training sessions.

A.17 Record Drawings

In addition to data required by general conditions, maintain temperature control record drawings on originals prepared by installing contractor and subcontractor. Include copies of these record drawings with operating and maintenance manuals.

Record Drawings shall be maintained by the contractor on a daily basis.

A.18 Manufacturers Field Services and Reports

When specified in individual specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.

Submit qualifications of observer to engineer 30 days in advance of required observations. Observer is subject to approval of engineer/architect and owner.

Individuals are to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

Submit report in duplicate within 15 days of observation to engineer for review.

B Materials

B.1 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 Division 09 – Finishes 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 application. Use largest size access opening possible, consistent with space and equipment needing service; minimum size is 12 x 12-inch.

B.2 Identification

Stencils: Not less than one-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 use of adhesive, tape or straps. Not less than one-inch high letters/numbers and flow direction arrows for piping marking.
W. H. Brady
Seton
Marking Services
Champion America
Or an approved 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
Emedolite- Style EIP by EMED Co.
Marking Services
W. H. Brady
Or an approved equal.

B.3 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.

Duct Penetrations:

a. Annular space between duct, with or without insulation, and non-rated partition or floor opening shall not be larger than two inches. Where existing openings have an annular space larger than two inches, patch space to match existing construction to within two inches around duct.

b. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide four-inch sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

C Construction

C.1 Demolition

Perform all demolition as indicated on drawings to accomplish new work.

Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize amount of contamination of occupied space.

Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new work.

Coordinate work with owner to minimize disruption to existing building occupants.

All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from site by contractor.

Piping and ductwork specialties are to be removed from site by contractor unless they are dismantled and removed or stored by owner.

Designated equipment is to be turned over to owner for its use at a place and time so designated.

Maintain condition of material and equipment that is indicated to be reused equal to that existing before work began.

C.2 Cutting and Patching

Cutting and patching of existing general construction (except pipe openings), as required to accommodate new system, will be provided by general contractor. Reference Division 01 - Cutting and Patching.

If contractor should neglect to inform other sections of work of his opening requirements before that portion of building construction has been complete, this contractor shall cut their own openings and provide framing and lintels as required.

Before cutting or drilling, he must obtain permission from engineer/architect, and he shall repair any damage to engineer/architect satisfaction.

In the event holes must be cut through reinforced concrete, drill carefully so as to avoid spalling and unnecessary damage or weakening of structural members.

No chopping or breaking will be permitted.

Repair surfaces damaged during installation of new system to complete satisfaction of owner and engineer/architect.

Do not cut through any building structural members without prior approval from engineer/architect.

Openings in general construction shall be neatly cut with smooth edges and opening shall be made only large enough to accommodate new system.

Pipe openings through reinforced concrete construction shall be core drilled.

Other openings shall be machine sawed.

Breaking or chopping out will not be permitted.

C.3 Building Access
Arrange for necessary openings in building to allow for admittance of all apparatus.

When building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after apparatus has been brought into building.

C.4 Equipment Access
Install piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service.

Coordinate exact location of wall and ceiling access panels and doors with general contractor, making sure that access is available for all equipment and specialties.

Where access is required in plaster walls or ceilings, furnish access doors to general contractor.

Provide color-coded thumb tacks or screws, depending on surface, for use in accessible ceilings which do not require access panels.

C.5 Coordination
Verify that devices are compatible for surfaces on which they will be used including, but not limited to, diffusers, register, grilles, and recessed or semi-recessed heating and cooling terminal units installed in or on architectural surfaces.

Coordinate 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 installing contractor's expense.

Cooperate with test and balance agency in ensuring compliance with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

Verify system completion to test and balance agency including;

a. Pressure testing.
b. Provide clean filters.
c. Duct and pipe system cleaning.
d. Controls adjusted and calibrated.
e. Controls cycled through their sequences are ready for testing, adjusting and balancing work.

Install dampers, shutoff and balancing valves, flow measuring devices, gauges, and temperature controls required for functional and balanced systems.

Demonstrate starting, interlocking and control features of each system so test and balance agency can perform its work.

C.6 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 nameplates 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 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.

Schedules in mechanical rooms to be framed under clear plastic.

Use engraved nameplates to identify control equipment.

Identify all fire and smoke dampers. Dampers shall be permanently identified on the exterior of the duct with a label, or painted, having a minimum letter height of one-inch. Identification shall read either “Fire Damper”, “Smoke Damper”, or “Fire/Smoke Damper”.

C.7 Lubrication
Lubricate bearings with lubricant as instructed by manufacturer before equipment is operated for any reason.

Once equipment has been run, maintain lubrication in accordance to manufacturer's instructions until the work is accepted by engineer/architect.

Maintain a log of lubricants used and frequency of lubrication and include this information in Operating and Maintenance Manuals at completion of project.

C.8 Sleeves
Pipe Sleeves:

a. Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping.
b. Patch wall around sleeve to match adjacent wall construction and finish.
c. Grout area around sleeve in masonry construction.
d. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall.
e. 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.
f. 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.
g. Extend top of sleeve one-inch above adjacent floor in piping floor penetrations located in mechanical rooms and wet locations listed below. In finished areas, sleeves shall be flush with rough floor.
h. 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-inch galvanized steel angles fastened to floor surrounding penetration or group of penetrations to prevent water from getting to penetration.
i. Place urethane sealant between angles and floor and fasten angles to floor minimum 8 inches on center.
j. Seal corners water tight with urethane sealant or core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout.
k. If pipe penetrating sleeve is supported by a pipe clamp resting on sleeve, weld a collar or struts to sleeve that will transfer weight to existing floor structure.
l. Wet locations include:
m. Exterior locations.
n. Tunnel.
o. Size sleeve to allow insulated pipe to run through sleeve and paint sleeve.
p. 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:

a. Duct sleeves are not required in non-rated partitions or floors.
b. Provide sleeve required for fire dampers in fire-rated partitions and floors.
c. Reference fire damper details on Drawings.
d. For duct penetrations through mechanical room floors and wet locations listed below, provide 1-1/2 x 1-1/2 x 1/8-inch galvanized steel angles fastened to floor around perimeter of duct opening to prevent water from getting to floor opening.
e. Provide urethane caulk between angles and floor and fasten angles to floor 8 inches on center.
f. Seal corners water tight with urethane caulk.
g. Wet locations include:
h. Exterior locations.
i. Tunnel.

C.9 Sealing and Firestopping

Fire and Smoke Rated Penetrations

a. Install approved product in accordance to manufacturer's instructions where pipes penetrate a fire and smoke rated surface.
b. When pipe is insulated, use a product which maintains integrity of insulation and vapor barrier.
c. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming.
d. Firestop mortar alone is not adequate to support any substantial weight.
e. Reference Division 07 – Firestopping.

Non-Rated Partitions:

a. At interior partitions and exterior walls, pipe penetrations are required to be sealed.
b. Apply sealant to both sides of penetration in such a manner that annular space between pipe sleeve or cored opening and pipe or insulation is completely blocked.

C.10 Project Closeout

Contractor shall provide the following submittal data prior to final site walk-through review.

Closeout Data Submittals:

a. Record Drawing submission.
b. Air balance test reports.
c. Operating and maintenance manuals.
d. Instructional walk-through and training.
e. Inspector’s test reports as follows:
f. Fire department inspector.
g. HVAC inspector.
h. Pipe Pressure test reports as follows:
i. Special systems.
j. Refrigerant leak test.

k. System startup reports:
l. Temperature control equipment.
m. Closeout statements:
n. Work completion.
o. Warranty statements.
p. Punch list completion.

C.11 HVAC Painting
Reference Division 09 – Finishes for paint and coating application requirements.

All exposed steel support structures including all metal surfaces located both inside and outside the building, shall be painted after installation with one coat of compatible metal primer coat and two finish coat applications. Color shall be gray unless specified.

All exposed piping, including uninsulated piping located inside the building, exposed to weather and exposed piping inside building shall be painted after installation with one coat of compatible metal primer and two finish coat applications.

Piping systems shall be clearly identified after painting with pipe markings as specified.

71. Hangers and Supports for HVAC Piping and Equipment, Section 23 05 29.

A Description
A.1 Summary
Section Includes:
a. Structural supports
b. Pipe hangers and supports
c. Beam clamps
d. Wood structure supports
e. Concrete inserts
f. Roof-mounted supports
g. Equipment curbs
h. Pipe penetrations through roof
i. Corrosive atmosphere coatings

Related Sections:
a. Applicable provisions of Section 23 05 00 shall govern all work under this Section.
b. Section 23 05 00 - Basic HVAC Requirements.
c. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
d. Section 23 07 00 - HVAC Insulation.

A.2 References
ASTM International:

a. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
b. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
c. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

Manufacturers Standardization Society (MSS):

a. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
b. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

A.3 Description
Provide supporting devices as required for installation of mechanical equipment and materials.

Supports and installation procedures are to conform to latest requirements of ANSI Code for pressure piping.

Do not hang any mechanical item directly from a metal deck or run piping so it rests on 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.

A.4 Submittals
Section 23 05 00 - Submittal Procedures: Requirements for submittals.

Submit 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 – Basic HVAC Requirements.

A.5 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 equipment, whichever is greater.

Standard pipe hangers and supports as specified in this section are required beyond 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 entire assembly is mounted on vibration supports.

Vibration isolation supports are required for a distance of one hundred pipe diameters or three supports away from equipment, whichever is greater.

Piping flexible connection and vibration isolation supports are not required when 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 piping and beyond 100 pipe diameter/3 support distance.

Piping supported by laying on 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, and the like.

B Materials

B.1 Pipe Hanger and Support Manufacturers

Manufacturers:

- B-Line
- Fee and Mason
- Anvil
- Kindorf
- Michigan Hanger
- Unistrut
- Substitutions: In accordance to Section 23 05 00 – Basic HVAC Requirements.

Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

B.2 Structural Supports

Provide all supporting steel required for 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.

B.3 Pipe Hangers and Supports

Hangers for Steel Pipe Sizes 1/2-Inch through 2-Inch: Carbon steel, adjustable, clevis, black finish. Provide Anvil Figure 65 or 260.

Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods if calculations are submitted.

Wall Support:

a. Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.
b. Perforated epoxy painted finish, 16-12-gauge minimum, steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps.
c. B-Line type S channel with B-2000 series clamps, Anvil Type PS200 H with PS 1200 clamps.
d. When copper piping is being supported, provide flexible elastomeric / thermoplastic isolation cushion material to completely encircle piping and avoid contact with channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT Series, Anvil Cushion clamp assembly.

Vertical Riser Support: Carbon steel riser clamp, copper plated when used with copper pipe. Anvil Figure 261 for steel pipe, figure CT121 for copper pipe.

Floor Support for Pipe Sizes through 4-Inch: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

Copper Pipe Support: Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.

Insulation Protection Shields: Galvanized carbon steel of not less than 18-gauge for use on insulated pipe 2-1/2-inch and larger. Minimum shield length is 12 inches. Equal to Anvil figure 167.

Steel Hanger Rods:

a. Threaded both ends, threaded one end, or continuous threaded, black finish.
b. Size rods for individual hangers and trapeze support as indicated in the following schedule.
c. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed limits indicated.

Maximum Load (Lbs.) (650 Degrees 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.

B.4 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. Anvil Figure 86.

B.5 Concrete Inserts
Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating.

Use drill bit of same manufacturer as anchor; manufacturer: Hilti, Rawl, or Redhead.

B.6 Roof Mounted Supports
Manufacturers:

a. Custom Curb
b. Pate
c. Roof Products and Systems
d. ThyCurb
e. Vent Products
f. Substitutions: In accordance to Section 23 05 00 – Basic HVAC Requirements.

Height of Supports: Based on length of main support member, height of support member above roof deck to be as follows:

Length of Support Member (inches)	Minimum Height of Support Above Deck
Up to 36	18
37 and over	36

Supports 18-Inch or Less in Height: Constructed of not less than 18-gauge galvanized steel reinforced so it is structurally capable of supporting intended load with no penetrations through curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counterflashing with attached galvanized steel channel track for securing pipe or duct roller and roller support. Do not use built-in metal base flashings or cants.

Supports 37-Inch or More in Height: Use galvanized structural steel members supported by pipe supports and use pipe or duct rollers fastened to structural member. Pipe supports to be secured to roof structure with roof penetration as specified below. All steel exposed to weather to be galvanized.

B.7 Equipment Curbs

Manufacturers:

a. Custom Curb
b. Pate
c. Roof Products and Systems
d. ThyCurb
e. Vent Products
f. Substitutions: In accordance to Section 23 05 00 – Basic HVAC Requirements

Constructed of not less than 18-gauge galvanized steel reinforced so it is structurally capable of supporting intended load with no penetrations through curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal 2-inch wood nailer, galvanized steel counterflashing.

Do not use built-in metal base flashings or cants. Use 18-inch high equipment curbs where curb completely surrounds perimeter of equipment and there is no roof exposed to weather.

B.8 Pipe Penetrations Through Roof

Manufacturers:

a. Custom Curb
b. Pate
c. Roof Products and Systems
d. ThyCurb
e. Vent Products
f. Substitutions: In accordance to Section 23 05 00 – Basic HVAC Requirements

Curb assembly constructed of not less than 18-gauge galvanized steel reinforced so it is structurally capable of supporting intended load, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal 2-inch wood nailer, laminated acrylic clad thermoplastic cover with graduated step boots to accommodate various size pipes, fastening screws for cover, and stainless steel clamps for securing boots around pipe.

Do not use built-in metal base flashings or cants. Height of curb assembly shall be minimum of 12 inches.

A stack flashing penetration may be utilized for single pipe penetrations through built-up roofs and single ply membrane roofs.

B.9 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.

Mechanically galvanize threaded products, ASTM B695 Class 150, 2.0 mil coating.

Field cuts and damaged finishes shall be field coated with zinc rich paint of comparable thickness of factory coating.

Corrosive atmospheres include the following locations:

a. Exterior locations
b. Chemical storage and hazardous waste storage rooms
c. Wet wells
d. Sanitary pumping stations
e. Meter Pits

C Construction

C.1 Installation

Install supports to provide for free expansion of piping and duct system.

Support piping from structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands.

Fasten ceiling plates and wall brackets securely to structure and test to demonstrate adequacy of fastening.

Coordinate hanger and support installation to properly group piping of all trades.

Where piping can be conveniently grouped to allow use of trapeze type supports, use standard structural shapes or continuous insert channels for supporting steel.

Perform welding in accordance to standards of 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.

C.2 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 same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain slope specified in piping section of this specification.

Space hangers for pipe as follows:

Pipe Material	Pipe Size (inches)	Maximum Spacing
Thermoplastic	All sizes	6'-0"
Copper	1/2 through 1-1/4	5'-0"
Copper	1-1/2 and larger	8'-0"

C.3 Vertical Riser Clamps
Support vertical piping with clamps secured to piping and resting on building structure or secured to building structure below at each floor.

C.4 Concrete Inserts
Select size based on manufacturer's stated load capacity and weight of material that will be supported.

C.5 Roof Mounted Supports
Use for all pipe on roof.

Secure bottom of support flat on roof deck.

Apply two coats of zinc rich paint to cut edges of all galvanized steel elements.

Flashing and counter-flashing shall be provided and installed by the general contractor.

C.6 Equipment Curbs
Secure bottom of support flat on roof deck. Secure equipment to curb in accordance to equipment manufacturer's instructions.

Flashing and counter-flashing shall be provided and installed by the general contractor.

C.7 Pipe Penetration Through Roof
Install at points where pipes penetrate roof.

Install as indicated on approved Shop Drawings, as detailed, and according to manufacturer's installation instructions.

Flashing and counter-flashing shall be provided and installed by the general contractor.

72. Vibration and Seismic Controls for HVAC Piping Equipment, Section 23 05 48.

A Description

A.1 Summary

Section Includes:

a. Neoprene pad.
b. Spring with neoprene.
c. Spring hangers.
d. Horizontal thrust restraint.
e. Flexible piping connections.

Related Sections:

a. Applicable provisions of Section 23 05 00 shall govern all work under this Section.
b. Section 23 05 00 - Basic HVAC Requirements.
c. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
d. Section 23 33 00 - Air Duct Accessories.
e. Section 23 34 00 - HVAC Fans.

A.2 Design Requirements

Isolate motor driven mechanical equipment from building structure and from systems which they serve to prevent equipment vibrations from being transmitted to structure.

Consider equipment weight distribution to provide uniform isolator deflections.

For equipment with variable speed capability, select vibration isolation devices based on 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 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 in an assembly where 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 inherent flexibility and vibration absorption characteristics of mechanical grooved pipe connections providing that supporting calculations are submitted for approval.

Coordinate selection of devices with isolator and equipment manufacturers.

A.3 Submittals
Section 23 05 00 - Submittal Procedures: Requirements for submittals.

Include isolator type, materials of construction, isolator free and operating heights, and isolation efficiency based on lowest operating speed of equipment supported.

B Materials
Use materials that will retain their isolation characteristics for life of equipment served.

Use industrial grade neoprene for elastomeric materials.

Treat isolators to resist corrosion.

For isolation devices exposed to 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.

B.1 Vibration Isolator Manufacturers
Mason Industries.

Peabody Noise Control, Inc.

VMC Group.

Substitutions: In accordance to Section 23 05 00.

B.2 Systems
Type 5: Spring Hanger with Neoprene:

a. Vibration hanger with a steel spring and 0.3-inch deflection neoprene element in series.
b. Use neoprene element molded with a rod isolation bushing that passes through hanger box.
c. Select spring diameters and size hanger box lower holes large enough to permit hanger rod to swing through a 30-degree arc before contacting hole and short-circuiting spring.
d. Select springs so they have a minimum additional travel to solid equal to 50 percent of rated deflection.
e. Manufacturer: Mason Type 30N or W30 or approved equal.
f. Type T: Horizontal Thrust Restraint:

g. Spring element in series with a neoprene pad as described for Type 3 mount with same deflection as specified for mounting or hanger.
h. Design assembly so spring element is contained within a steel frame, so it can be preset for thrust at factory, and adjusted in field for a maximum of 1/4-inch movement at start and stop.
i. Include threaded rod and angle brackets for attachment to both equipment and ductwork or equipment and structure.
j. Manufacturer: Mason Type WB or approved equal.

B.3 Flexible Piping Connections
Suitable for pressure, temperature, and fluid involved; minimum pressure rating for any system is 125 psig at design temperature of fluid. Provide 12-inch minimum length of flexible hose or length required to absorb 3/4-inch lateral movement, whichever is greater.

Manufacturers:
a. Flexonics.
b. Mason Industries.
c. Mercer Rubber Company.
d. The Metraflex Company.
e. U.S. Hose Corporation.
f. Substitutions: In accordance to Section 23 05 00.

Refrigerant: Seamless bronze corrugated flexible hose with bronze wire braided cover and solder type copper tube ends with entire assembly fabricated specifically for refrigerant duty.

B.4 Performance
Select vibration isolation devices as indicated below or to provide not less than 95 percent isolation efficiency, whichever is greater.

	Floor Span or Column Spacing									
	--On Grade---		--20 Feet--		--30 Feet---				--40 Feet—	
		Min. Static		Min. Static		Min. Static				Min. Static	
		Iso.		Defl.	Iso.	Defl.	Iso.	Defl.	Iso.	Defl.
TYPE OF EQUIPMENT	Type	In.	Type	In.	Type	In.	Type	In.		

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 percent of equipment weight.

Floor Mounted:
Type 2-T for 0.35-inch deflection, Type 3-T for 0.75-inch deflections and Type 3-S-T for deflections over 0.75-inch with deflection from blower minimum deflection guide.

Piping Connected to Rotating or Reciprocating Equipment:
Flexible piping connections and Type 5 or 6 hangers for a distance of 100 pipe diameters or a distance of three hangers away from equipment, whichever is greater. Where piping is floor supported, above requirement apply, but use Type 3 mounts instead of Type 5 or 6 hangers.

Vertical Pipe Risers Greater Than 30 Feet in Height:
Refer to drawings for riser design information.

Ductwork in Mechanical Equipment Rooms:
Use Type 7 hanger with 0.75-inch minimum deflection for all ducts with a cross sectional area greater than 2.0 square feet and, where either air velocity is great than 3500 fpm or, pressure class is 4-inch water column or higher.

B.5 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

C Construction
C.1 Installation
Install vibration isolation devices for motor driven equipment in accordance to manufacturer's installation instructions.

Set steel and inertia bases for 1-inch clearance between concrete floor or housekeeping pad and base.

Do not allow installation practices to short circuit any isolation device.

Install flexible piping connections on equipment side of shut-off valves.

C.2 Packaged Air Handling Units and Centrifugal Fans
Attach horizontal thrust restraints at centerline of thrust and symmetrically on either side of unit.

Thrust restraints are not required when fan section in not isolated from remainder of air handling unit by means of duct flexible connections.

C.3 Isolation Devices Outdoors or in High Humidity Areas
Use only hot dip galvanized, stainless steel, or neoprene coated steel parts.

73. Electric Instrumentation and Control Devices for HVAC, Section 23 09 14.

A Description
A.1 Summary
Section Includes:

a. Control Dampers
b. Control Valves
c. Control System Instrumentation
d. Thermostats
e. Duct Smoke Detector and Fire Alarm Interface Modules
f. Air Flow Stations
g. Flow Measurement
h. Time Clocks
i. Temperature Control Panels
j. Temperature Sensors
k. Humidity Sensors
l. Pressure Transducers
m. Differential Pressure Switches
n. Carbon Dioxide (CO2) Sensor

Related Sections:

a. Applicable provisions of Section 23 05 00 shall govern all work under this Section.
b. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Coordination.
c. Section 23 09 93 - Sequence of Operation for HVAC Controls.
d. Section 23 33 00 – Air Duct Accessories: Control damper installation.

A.2 Quality Assurance
Installing contractor must be a manufacturer's branch office or an authorized representative of control equipment manufacturer that provides engineering and commissioning of manufacturers control equipment.

Submit written confirmation of such authorization from manufacturer.

Indicate in letter of authorization that installing contractor has successfully completed necessary training required for engineering, installation, and commissioning of equipment and systems to be provided for project, and that such authorization has been in effect for a period of not less than three years.

DDC equipment may or may not be required to be installed by this contractor as part of project, but the intent of this quality assurance specification is to ensure that installing contractor has capabilities to engineer, install, and commission field devices supplied under this section for temperature control.

A.3 References

Air Movement and Control Association (AMCA)

a. AMCA 500-D-Laboratory Method of Testing Dampers for Rating.

American Society of Mechanical Engineers (ASME)

ASTM International

a. ASTM D635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
b. ASTM D1693 - Environmental Stress-Cracking of Ethylene Plastics.

Fluid Controls Institute (FCI)

a. FCI 70-2 - Control Valve Seat Leakage.

Underwriters Laboratories, Inc. (UL)

a. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

A.4 System Description

System is to be electric/electronic.

Pneumatic tubing and electrical wiring are to be permanently tagged or labeled within one inch of terminal strip with a numbering system to correspond with Record Drawings.

A.5 Submittals

Section 23 05 00 – Basic HVAC Requirements: - Submittal Procedures: Shop drawings, product data and samples.

Submit the following information:

a. Manufacturer's data sheets indicating model number, pressure and temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance.
b. General catalog sheets showing a series of same device is not acceptable unless specific model is clearly marked.
c. Include temperature sensor color information offered by the manufacturer for engineer approval.
d. Schematic flow diagrams of systems showing fans, dampers, and other control devices.
e. Label each device with setting or adjustable range of control.
f. Indicate wiring, clearly, differentiating between factory and field installed wiring.

g. Wiring should be shown in schematics that detail contact states and relay references; Diagrammatic representations of devices alone are not acceptable.
h. Details of construction, layout, and location of each temperature control panel within building, including instruments location in panel and labeling.
i. Include on shop drawings location of mechanical equipment controlled by room number, horsepower and flow of motorized equipment when this data is available on drawings, locations of remote sensors and control devices by room number or column lines.
j. Schedule of control dampers indicating size, leakage rating, arrangement, pressure drop at design airflow, and number and size of operators required.
k. A complete description of each control sequence for equipment that is not controlled by direct digital controls.
l. Prior to request for final payment, submit record documents which accurately record actual location of control components including panels, thermostats, wiring, and sensors. Incorporate changes required during installation and start-up.

Operating and Maintenance Manuals: Furnish three bound operating and maintenance manuals for review and approval prior to substantial completion, performance testing, and training. Manuals to include the following:

a. Operation and maintenance instructions for equipment and systems provided.
b. Recommendations for frequency of service and preventative maintenance.
c. List indicating types and grades of oil and grease, packing materials, normal and abnormal tolerances for devices, and method of equipment adjustment.
d. Description of recommended replacement parts and materials which owner should stock.
e. A summary of equipment vendors, or location where replacement parts can be purchased.
f. Manufacturer's literature indicating features, materials of construction, and operating limits of installed equipment. Brochures giving brief descriptions of multiple pieces of control apparatus are not acceptable.
g. A complete set of control Record Drawings.
h. Name, address, and telephone number of person or office to contact for service during warranty period.
i. Name, address, and telephone number of person or service organization to be contacted for service after warranty period.

A.6 Demolition

Where existing control devices, piping, or wiring are discontinued from use, remove and turn over to Construction Manager.

Remove any previously abandoned control devices in a similar manner.

A.7 Design Criteria

Size control apparatus to properly supply and operate and control apparatus served.

Provide control devices subject to corrosive environments with corrosion protection or construct control devices so they are suitable for use in such an environment.

Provide devices exposed to outside ambient conditions with weather protection or construct devices so they are suitable for outdoor installation.

Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet requirements of electrical sections in Division 26 – Electrical.

A.8 Material Delivery and Storage
Provide factory shipping cartons for each piece of equipment and control device. Contractor is responsible for storage of equipment and materials inside and protected from weather.

B Materials
B.1 Instrumentation and Control Devices
Manufacturers:
Johnson Controls, Inc.
Honeywell
Siemens
Invensys, Siebe
Kreuter, KMC
Or approved equal.

B.2 Air Piping
ASTM B75 seamless, hard drawn or annealed copper tubing with ASME B16.22 wrought copper fittings, except final connections to apparatus may be made with brass compression-type fittings. Use ASTM B32, 95/5 tin antimony solder.

Virgin polyethylene plastic tubing classified as flame retardant under UL 94 and conforming to ASTM D1693 stress-crack test.

B.3 Electric/Electronic Thermostats
Electric Thermostats:

a. For single setpoint applications, provide line or low voltage electric type suitable for heating or heating and cooling as required.
b. Provide required number of heating and cooling stages required for application.
c. For line voltage ventilation applications utilizing fans and where otherwise specified in sequence of operations, provide an integral manual On/Off/Auto selector switch.
d. Minimum contact rating shall be equal to electrical load of device being controlled.
e. Manufacturers:
f. Honeywell
g. Johnson Controls
h. Viconics

i. Or approved equal.
j. Where unoccupied setpoints are specified, provide electronic programmable type with seven-day setup/setback scheduling with a minimum of two occupied and unoccupied schedules per day through keypad entry on front of unit.
k. For applications that control fans, provide fan override switch.

C Construction

C.1 Installation

Install system with trained mechanics and electricians employed by control equipment manufacturer or an authorized representative of manufacturer.

Where installing contractor is an authorized representative of control manufacturer, such authorization shall have been in effect for a period of no less than three years.

Install control equipment, accessories, wiring, and piping in a neat and workmanlike manner.

Control devices must be installed in accessible locations.

Contractor shall verify that all control devices furnished under this Section are functional and operating mechanical equipment as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls.

Label control devices with exception of dampers, valves, and terminal unit devices with permanent printed labels that correspond to control drawings.

Identify temperature control junction and pullboxes by using spray painted green covers.

Other electrical system identification shall follow Division 26 – Electrical.

Mount control devices and electrical boxes mounted on insulated ductwork over insulation.

Provide mounting stand-offs where necessary for adequate support.

Cutting and removal of insulation to mount devices directly on ductwork is not acceptable.

This contractor shall coordinate with insulation contractor to provide for continuous insulation of ductwork.

Protect mounting of electrical or electronic devices from weather if building is not completely enclosed.

This contractor shall be solely responsible for replacing any equipment that is damaged by water that infiltrates building if equipment is installed prior to building being enclosed.

Provide electrical relays and wiring, line and low voltage, for control systems, devices, and components.

Install high voltage and low voltage wiring, including low voltage cable, in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit.

Reference Wire Conduit Installation Schedule below for specific conduit or tubing to be used.

Conduit shall be installed in accordance to Division 26 of this specification and National Electrical Code.

Conduit shall be a minimum of 1/2-inch for low voltage control provided pipe fill does not exceed 40 percent.

Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. Low voltage wiring to be stranded.

Low voltage wiring can be run without conduit above accessible lay-in tile ceilings.

Wiring in mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in other locations shall be in conduit.

Wire for wall sensors must be run in conduit.

Where wiring is installed free-air, installation shall be as follows:

a. Wiring shall utilize cable tray wherever possible.
b. Wiring shall run at right angles and be kept clear of other trades work.
c. Support wiring using "J" or "Bridal-type" steel mounting rings anchored to ceiling concrete, piping supports, walls above ceiling or structural steel beams.
d. Mounting rings shall be of open design (not a closed loop) to allow additional wire to be strung without being threaded through ring.
e. For mounting rings that do not completely surround wire, attach wire to mounting ring with a strap.
f. Space supports at a maximum 4-foot interval unless limited by building construction. If wiring "sag" at mid-span exceeds 6 inches; provide an additional support.

g. Wiring shall never be laid directly on ceiling grid or attached in any manner to ceiling grid wires.
h. Sleeve wall penetrations.
i. Do not attach wring to existing cabling, existing tubing, plumbing or steam piping, ductwork, ceiling supports, or electrical or communications conduit.

This contractor shall be responsible for 120 VAC power, not provided in Division 26 specifications, required for equipment provided under this section.

After completion of installation, test and adjust control equipment.

Submit data showing set points and final adjustments of controls.

C.2 Wire Conduit and Tubing Installation Schedule
Following conduit schedule shall apply to both polyethylene tubing and wire in conduit where conduit is specified for air tubing or wiring.

Conduit and tubing referenced below shall meet specifications in Division 26 - Electrical and as defined below.

Conduit other than that specified below for specific applications shall not be used. Comply with following schedule:
a. Exposed Outdoor Locations: Rigid steel conduit.
b. Concealed in Concrete and Block Walls: Rigid steel conduit.
c. Concealed Dry Interior Locations: Rigid steel conduit.
d. Exposed Dry Interior Locations: Rigid steel conduit.

C.3 Room Thermostats and Temperature Sensors
Check and verify location of thermostats, humidistats, and other exposed control sensors with drawings and room details before installation.

Locate room thermostats and sensors 48 inches above floor.

Align with light switches and humidistats.

For drywall installations, thermostat mounting shall use a back-box attached to a wall stud. Drywall anchors are not acceptable.

Mount any room thermostats or sensors mounted on an exterior wall on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.

Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect measured temperature or humidity seal conduit and any other opening that will effect measurement.

74. HVAC Ducts and Casings, Section 23 31 00.

A Description

A.1 Summary

Section Includes:

a. Low pressure ductwork
b. Duct sealant
c. Gaskets

Related Sections:

a. Applicable provisions of Section 23 05 00 shall govern all work under this section.
b. Section 23 01 30 – HVAC Air Duct Cleaning.
c. Section 23 05 00 - Basic HVAC Requirements.
d. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
e. Section 23 07 00 – HVAC Insulation.
f. Section 23 33 00 – Air Duct Accessories.

A.2 References

American National Standards Institute (ANSI)

a. ANSI SS-EN 485-2 - Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties.

ASTM International

a. ASTM A90 - Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
b. ASTM A167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
c. ASTM A527 - Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
d. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
e. ASTM A924 - Specification for General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Method.
f. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
g. ASTM C411 - Test Method for Hot Surface Performance of High Temperature Thermal Insulation.
h. ASTM C916 - Specification for Adhesives for Duct Thermal Insulation.
i. ASTM C1071 - Specification for Fibrous Glass Duct Lining Insulation.
j. ASTM C1338 - Test Method for Determining Fungal Resistance of Insulation Materials and Facings.
k. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
l. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

National Fire Protection Association (NFPA)

a. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
b. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

North American Insulation Manufacturers Association (NAIMA)

a. NAIMA - Fibrous Glass Duct Liner Standard.

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

Underwriters Laboratories, Inc. (UL)

a. UL 181 - Standard for Safety for Factory Made Air Ducts and Air Connectors.

A.3 Submittals

Section 23 05 00 – Basic HVAC Requirements - Submittal Procedures: Shop drawings, product data and samples.

Submit manufacturer's data and contractor data for the following:

a. Fabrication and installation drawings.
b. Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, with details as appropriate.
c. Duct sealant and gasket material.

A.4 Design Criteria

Construct ductwork to be free from vibration, chatter, objectionable pulsations, and leakage under specified operating conditions.

Use material, weight, thickness, gauge, and construction and installation methods as outlined in the following Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) publications, unless noted otherwise:

a. HVAC Duct Construction Standards, Metal and Flexible, Latest Edition.
b. HVAC Air Duct Leakage Test Manual, Latest Edition.
c. HVAC Systems - Duct Design, Latest Edition.
d. Rectangular Industrial Duct Construction Standard, Latest Edition.

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.

A.5 Delivery, Storage and Handling

Promptly inspect shipments to ensure that ductwork is undamaged and complies with 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 or packaging are provided, take precautions so caps or packaging remain in place and free from damage.

Offsite storage agreements do not relieve contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

B Materials

Galvanized Steel Sheet:

a. ASTM A653, galvanized steel sheet of lock forming quality.
b. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance to ASTM A90.

B.1 General

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-inch and below may be 26-gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, latest edition.

Duct sizes indicated on Drawings are net inside dimensions. Where duct liner is specified, dimensions are net, inside of liner.

B.2 Ductwork Pressure Class

Minimum acceptable duct pressure class, for ductwork except transfer ductwork, is 2-inch W.G. positive or negative, depending on application.

Transfer ductwork minimum acceptable duct pressure class is 1-inch W.G. positive or negative, depending on application.

Duct system pressure classes not indicated on Drawings to be as follows:

Duct System	Pressure Class
Supply duct	2 inch pressure class
Transfer ducts	1 inch pressure class
Exhaust ducts	2 inch pressure class
Return ducts	2 inch pressure class
Relief ducts	2 inch pressure class
Other duct systems	2 inch pressure class

B.3 Low Pressure Ductwork (Maximum 3 Inch Pressure Class)
Fabricate and install ductwork in sizes indicated on drawings and in accordance to SMACNA recommendations, except as modified below.

Construct so that 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 screw does not extend more than 1/2-inch into duct.

Use elbows and tees with centerline 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, Type RE 3.

Where space will not allow and C value of radius elbow, as given by SMACNA, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00 – Air Duct Accessories.

Square throat-radius heel elbows shall not be acceptable. Straight taps or bullhead tees are also not permitted.

Where rectangular elbows are used, provide turning vanes in accordance to Section 23 33 00 – Air Duct Accessories.

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 are unacceptable.

Button punch snaplock construction will not be accepted on aluminum ductwork.

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.

B.4 Duct Sealant
Manufacturers:
a. 3M 800
b. 3M 900
c. H.B. Fuller/Foster
d. Hardcast

e. Hardcast Peal and Seal
f. Lockformer Cold Sealant
g. Mon-Eco Industries
h. United Sheet Metal
i. Or approved equal.

Silicone sealants will not be 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 startup of air handling systems.

B.5 Gaskets
Two-Inch Pressure Class and Lower: Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

Three-Inch Pressure Class and Higher: Butyl gaskets.

Fume Hood Exhaust: Butyl gaskets.

C Construction
C.1 Installation
Verify dimensions at site, making field measurements and drawings necessary for fabrication and erection.

Check drawings showing work of other trades and consult with engineer in 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 6 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 - Testing, Adjusting, and Balancing for HVAC.

Provide frames constructed of angles or channels for coils, filters, dampers, or other devices installed in duct systems, and make 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, install joint in such a manner that metal ducts do not contact each other by using proper seal or compound.

Blank off unused portions of louvers, as indicated on 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 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 ductwork.

During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C.2 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-inch x 7-inch, stainless steel air-craft cable, with matching fastener rated for 150 percent 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.

C.3 Low Pressure Duct (Maximum 3 Inch Pressure Class)

Seal ducts, with exception of transfer ducts, in accordance to SMACNA seal class "A"; sealing transverse and longitudinal seams, joints, and penetrations.

Install a manual-balancing damper in each branch duct and for each diffuser or grille. 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.

C.4 Cleaning
Remove dirt and foreign matter from entire duct system and clean diffusers, registers, grilles, and 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.

75. Air Duct Accessories, Section 23 33 00.

A Description
A.1 Summary
Section Includes:

a. Manual volume dampers
b. Turning vanes
c. Gravity backdraft dampers
d. Access doors
e. Flexible duct
f. Flashings
g. Duct flexible connections
h. Sound attenuators
i. Louvers

Related Sections:

a. Applicable provisions of Section 23 05 00 shall govern work under this section.
b. Section 23 05 00 – Basic HVAC Requirements.
c. Section 23 05 29 – Hanger and Supports for HVAC Piping and Equipment.
d. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.
e. Section 23 09 14 –Electrical Instrumentation and Control Devices for HVAC.
f. Section 23 09 93 – Sequence of Operations for HVAC Controls.
g. Section 23 31 00 – HVAC Ducts and Casings.

A.2 References
Air Movement and Control Association International, Inc. (AMCA)

a. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

ASTM International

a. ASTM C411 – Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
b. ASTM C916 - Specification for Adhesives for Duct Thermal Insulation.
c. ASTM C1071 – Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material.
d. ASTM C1338 – Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
e. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
f. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

National Fire Protection Association (NFPA)

a. NFPA 90A - Standard for Installation of Air Conditioning and Ventilating Systems.

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

a. SMACNA - HVAC Duct Construction Standards - Metal and Flexible, Latest Edition.

Underwriters Laboratories, Inc. (UL)

a. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors.
b. UL 214 - Test for Flame-Propagation of Fabrics and Films.

A.3 Submittals

Section 23 05 00 - Basic HVAC Requirements - Submittal Procedures: Shop Drawings, product data and samples.

Submittals for accessories shall 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.

Include performance data for air blenders.

Submit manufacturer's color charts where finish color is be selected by engineer/architect.

B Materials

B.1 Manual Volume Dampers

Manufacturers:

a. Ruskin
b. Vent Products
c. Air Balance
d. Or approved equal.

Construct dampers in accordance to SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

Reinforce 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 are unacceptable.

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 volume damper rods penetrating ductwork constructed to a 3-inch water column pressure class or above.

B.2 Turning Vanes

Manufacturers:

a. Aero Dyne
b. Anemostat
c. Barber-Colman
d. Hart & Cooley
e. 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 turn in accordance to SMACNA Fig. 2-5 and Fig. 2-6.

B.3 Gravity Backdraft Dampers

Manufacturers:

a. Ruskin Model CBD4 or equivalent.
b. Air Balance.
c. Advanced Air
d. Cesco
e. American Warming and Ventilating.
f. Vent Products Company, Inc.
g. Greenheck.
h. Arrow.
i. Or approved equal.

Dampers shall be adjustable type, counterbalanced, self-acting, multiple bladed backdraft air dampers of sizes indicated or required.

Dampers shall begin to open in the desired direction of airflow when the upstream to downstream differential static pressure reaches approximately 0.05 to 0.10 inches of water column.

Blades shall be constructed of 0.070 inch thickness aluminum with a 6 inch maximum blade width, interlocking neoprene or extruded vinyl blade edge seals, dust proof ball bearing shaft supports, interconnecting linkage and adjustable counterbalancing weights.

Frame shall be constructed of 0.081 thickness extruded aluminum

B.4 Access Doors

Manufacturers:

a. Ruskin
b. Air
c. Balance
d. Advanced Air
e. Arrow
f. Vent Products Co., Inc.
g. Greenheck
h. Or approved equal.

Design and construct access door for pressure class of duct receiving door installation.

Doors in exposed areas shall be hinged type with cam sash lock.

Hinges shall be steel full- length continuous piano type.

Secure doors in concealed spaces with cam sash latches.

For both hinged and non-hinged doors provide sufficient number of cam sash latches to provide airtight seal when door is closed.

Do not use hinged doors in concealed spaces if this will restrict access.

Use minimum 1-inch deep 24-gauge galvanized steel double wall access doors with minimum 24-gauge galvanized steel frames.

For non-galvanized ductwork, use minimum 1-inch deep double wall access door with frame using materials of construction identical to adjacent ductwork.

Provide double neoprene gasket that seals from frame to door and frame to 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 are unacceptable.

B.5 Flashings
Provide flashing to completely weatherproof connection of ductwork to louvers. Construct flashing 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 in accordance to details.

B.6 Duct Flexible Connections
Material to be fire retardant, UL 214 listed, and meet 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 and contraction, vibration of connected equipment, and other movement.

Use coated glass fiber fabric. 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 degrees F and 200 degrees F, with 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 degrees F and 250 degrees F, with a nominal weight of 26 ounces per square yard.

Manufacturers:
a. Ventfabrics, Inc.
b. Or approved equal.

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 degrees F and 500 degrees F, with a nominal weight of 14 ounces per square yard:
a. Ventfabrics, Inc.
b. Or approved equal.

B.7 Louvers
Manufacturers:
a. Airolite K6776
b. Industrial Louvers 658
c. American Warming and Ventilating LE-31
d. Carnes FPCB
e. Vent Products co., Inc. 4650

f. Ruskin ELF6375 DX
g. Or approved equal.

Extruded aluminum alloy not less than 12-gauge, drainable blades, all-welded assembly, 35-degree or 45-degree blades with water baffle, 6 inches thick.

Provide with bird screen of 1/2 x 1/2-inch mesh aluminum in 12-gauge aluminum frame and an aluminum sill.

Locate bird screen inside of louver unless noted otherwise.

Louver to bear AMCA certified ratings seal for both air performance and water penetration, having free area not less than 50 percent based on a 48 x 48-inch section, water penetration less than 0.1 oz/square foot under AMCA 500-L test at 1000 feet per minute, and 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 engineer/architect.

Furnish sufficient paint in same color as louver to paint outer surface of panels over unused portions of louvers and to paint interior portion of ductwork visible through louvers.

C Construction

C.1 Manual Volume Dampers

Install manual volume dampers in each branch duct and each grille, register, or diffuser as far away from outlet as possible while still maintaining accessibility to damper.

Install so there is no flutter or vibration of damper blades.

Splitter dampers shall not be used in place out volume dampers.

C.2 Gravity Backdraft Dampers

Install at locations indicated on drawings.

Install access door for service and access to the damper.

Adjust counterbalance weight for proper operation.

C.3 Access Doors

Install access doors where specified, indicated on 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 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 inlet side of reheat coils and other duct-mounted coils.

C.4 Flashings
Flashing for roof curbs, equipment supports, or rails located on roof, will be installed by others.

C.5 Duct Flexible Connections
Install at duct connections to rotating or vibrating equipment, including air handling units, 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.

For applications in corrosive environments or fume exhaust systems, use a double layer of Teflon-coated fabric when making connection.

C.6 Louvers
Louvers are furnished and installed by others.

Provide bird screen on inside of active louver area where none is provided with louver. Where louvers are equipped with inside bird screen, remove screen at locations where duct connections are not made.

Install insulated metal panel on unused portion of louver. Seal panels weather tight 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 building, paint inside of duct to match louver color.

76. HVAC Fans.

A Description
A.1 Summary
Section Includes:

a. In-Line centrifugal fans.

Related Sections:

a. Applicable provisions of Section 23 05 00 shall govern work under this section.
b. Section 23 05 00 – Basic HVAC Requirements.
c. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

d. Section 23 05 13 - Motor Requirements for HVAC Equipment.
e. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

A.2 References

Air Movement and Control Association (AMCA)

a. AMCA 203 - AMCA Fan Application Manual - Troubleshooting
b. AMCA 210 - Laboratory Method of Testing Fans for Rating
c. AMCA 300 - Reverberant Room Method for Sound Testing of Fans

National Fire Protection Association (NFPA)

a. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems

A.3 Submittals

Section 23 05 00 – Basic HVAC Requirements - Submittal Procedures: Shop Drawings, product data and samples.

Submit dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification, and vibration isolation for 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 relationship of CFM to static or total pressure for various fan speeds.

Indicate brake horsepower, recommended selection range, and limits of operation on curves.

Indicate operating point on fan curves at design air quantity and indicate manufacturer's recommended drive loss factor for specific application.

Tabular fan performance data is not acceptable.

For variable air volume application, include data indicating effect of capacity control devices, such as inlet vanes, on performance.

A.4 Design Criteria

Tested and certify fans in accordance to applicable AMCA test code.

Each fan and motor combination shall be capable of delivering 110 percent of schedules air quantity at scheduled static pressure.

Motor furnished with fan shall not operate into 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 Drawings, provide any motor, drive, and 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 air stream are to meet flame spread and smoke ratings contained in NFPA 90A.

Provide all roof mounted equipment with curbs or equipment stands in accordance to specification in Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

B Materials

B.1 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. Single phase motors to have inherent thermal overload protection.

Reference Section 23 05 13 – Motor Requirements for HVAC Equipment for motor requirements.

Reference Section 23 05 48 – Vibration and Seismic Control for HVAC Piping and Equipment for vibration isolation requirements.

Provide variable pitch sheaves for drives 3 hp and smaller and fixed pitch sheaves for drives 5 hp and larger. Design drives for 150 percent of motor rating.

Use OSHA approved belt guards that totally enclose entire drive. Construct guards of expanded metal to allow for ventilation; provide tachometer openings at shaft locations.

Statically and dynamically balance fans so they operate without objectionable noise or vibration.

B.2 In-Line Centrifugal Fans

Manufacturers:

a. Acme Engineering & Manufacturing Corporation
b. Greenheck Fan Corporation
c. Loren Cook Company
d. New York Blower Company
e. Peerless Blowers

f. Twin City Fan & Blower
g. Or approved equal.

In-Line Centrifugal Fan Assembly:

a. Construct housing of welded steel with reinforcing to prevent distortion.
b. Furnish with streamlined inlet cones and multiple straightening vanes following fan wheel to minimize noise and reduce turbulence.
c. Provide each housing with a bolted and gasketed access door for inspection of drive and fan wheel.
d. Use non-overloading airfoil blade fans welded to wheel cones.
e. Isolate belt drives from air stream with a belt tube.
f. Externally mount motors on an adjustable base.
g. Bearings to be grease lubricated, self-aligning ball bearing type with grease seal and external grease fitting. Bearings rated for 200,000 hours average life.
h. Unless a special coating is scheduled, paint fans with a prime coat after metal cleaning and surface preparation.
i. Apply a second coat of paint to exterior surfaces.
j. Design vertically mounted fans to withstand vertical thrust loads.
k. Provide spring vibration isolators.
l. Factory mounted and pre-wired NEMA 1 fan motor disconnect switch.
m. Provide 1-inch galvanized mesh inlet screens for fans without inlet ductwork.
n. For direct drive units, furnish solid state variable speed controller for each fan. Speed controllers to be used for final air balancing.
o. Provide units with fiberglass internal acoustical housing liner.

C Construction

C.1 Installation

Install as shown on Drawings, as detailed, and according to manufacturer's installation instructions. On units provided with a drain connection, reduce drain connection down to 1/2-inch fitting and leave open.

Install thrust restraints in accordance to requirements of Section 23 05 48 – Vibration and Seismic Controls for HVAC.

Fan drive sheaves on belt driven units shall be adjusted or replaced by the contractor to provide design air volumes.

77. Diffusers, Registers and Grilles, Section 23 37 10.

A Description

A.1 Summary

Section Includes:

a. Side-wall registers and grilles.

Related Sections:

a. Applicable provisions of Section 23 05 00 shall govern work under this section.
b. Section 23 05 00 – Basic HVAC Requirements.
c. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
d. Section 23 31 00 - HVAC Ducts and Casings.
e. Section 23 33 00 - Air Duct Accessories.

A.2 References

Air-Conditioning and Refrigeration Institute (ARI)

a. ARI-ADC Standard 880.

ASTM International

a. ASTM D6386 - Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

National Fire Protection Association (NFPA)

a. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

Underwriters Laboratories, Inc. (UL)

a. UL 181 - Factory-Made Air Ducts and Connectors.

A.3 Submittals

Section 23 05 00 – Basic HVAC Requirements - Submittal Procedures: Shop drawings, product data and samples.

Furnish submittal information including, but not limited to, the following:

a. Manufacturer's name and model number.
b. Identification as referenced in documents.
c. Capacities/ratings.
d. Materials of construction.
e. Sound ratings.
f. Dimensions.
g. Finish.
h. Color selection charts where applicable.
i. Manufacturer's installation instructions.
j. Frame and border for each application.

A.4 Design Criteria

Basel performance data on tests conducted in accordance to Air Diffusion Council (ADC) Test Code 1062 GRD 84.

B Materials

B.1 Side Wall Registers and Grilles

Manufacturers:

a. Titus: Series 300 (Supply) and Series 350 (Return/Exhaust)
b. Carnes: Model R Series
c. Price Industries: Model 520 (Supply) and 530 (Return Exhaust)
d. MetalAire: Series V4000 or H4000
e. Krueger: Series 880
f. Or approved equal.

Side-Wall Registers And Grille Assembly:

a. Aluminum unless otherwise indicated, with frame type appropriate to installation.
b. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all directions.
c. Opposed blade volume control damper supply registers, operable from face.
d. Fixed blade 45-degree core return and exhaust registers and grilles.
e. Opposed blade volume control damper return registers, operable from face.
f. Register and grille sizes as shown on drawings and as scheduled. Unless noted otherwise, baked enamel finish with color selected by architect.
g. Screw holes on surface counter sunk to accept recessed type screws.

B.2 Door Grilles

Manufacturers:

a. Titus Series 700
b. Carnes Series RF or RG
c. MetalAire Series DG
d. Price Industries ATG/STG
e. Or approved equal.

Door Grille Assembly:

a. Aluminum. Sight tight.
b. Grille sizes, frame types, and finishes as shown on drawings and as scheduled. Unless noted otherwise, baked enamel finish with color selected by architect.

C Construction

C.1 Installation

Install grilles, registers, and diffusers as shown on drawings and according to manufacturer's instructions.

Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

Seal connections between ductwork drops and diffusers/grilles airtight. The use of duct tape or insulating tape is not acceptable.

Where diffusers, registers, and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

Coordinate door grille sizes, locations, and installation with work of other trades.

Grilles and registers shall be securely and neatly attached to the building construction or sheet metal flanges.

78. Packaged Terminal Air Conditioning Units, Section 23 81 13.

A Description
A.1 Summary
Section Includes:

a. Packaged terminal air conditioning units.

Related Sections:

a. Applicable provisions of Section 23 05 00 – HVAC General Requirements shall govern all work under this Section.
b. Section 23 05 00 – Basic HVAC Requirements.
c. Section 23 09 14 - Electric Instrumentation and Control Devices for HVAC: Installation of thermostats and other control components.
d. Division 26 - Electrical: Equipment Wiring Systems: Installation of thermostats and other control components.
e. Division 26 - Electrical: Equipment Wiring Systems: Electrical characteristics and wiring connections.

A.2 References
Air Conditioning and Refrigeration Institute (ARI):

a. ARI 210 - Unitary Air-Conditioning Equipment.
b. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
c. ARI 310/380 – Packaged Terminal Air Conditioners and Heat Pumps

National Fire Protection Association (NFPA):

a. NFPA 70 - National Electrical Code.

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

a. ASHRAE 90.1 – Energy Standards for Buildings Except for Low-Rise Residential Buildings.

National Electrical Code (NEC)

A.3 Submittals
Section 23 05 00 - Basic HVAC Requirements – General Requirements: Procedures for submittals.

Product Data: Provide drawings indicating capacities, dimensions, rough-in connections, and electrical characteristics and connection requirements.

A.4 Closeout Submittals
Section 23 05 00 - Basic HVAC Requirements – Operation and Maintenance Data: Procedures for submittals.

Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

A.5 Quality Assurance
Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

Unit Energy Efficiency Ratio (EER), Coefficient of Performance (COOP) shall meet the minimum applicable requirements of ASHRAE 90.1 (Current Edition). Units that are labeled ENERGY STAR® will be acceptable.

Rate unit performance in accordance to the latest edition of ARI Standard 310/380 or ARI Standard 210/240, whichever is applicable for the equipment.

Construct units in accordance to ASHRAE 15, UL standards and the NEC. Units shall carry the UL label.

Factory run test units to see that each control device operates properly. Pressure test, evacuate, charge with holding charge of refrigerant and full oil charge prior to shipping from the factory.

A.6 Regulatory Requirements
Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for purpose specified and indicated.

A.7 Delivery, Storage and Protection
Deliver, store and protect products under provisions of Section 23 05 00 - Basic HVAC Requirements.

Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

A.8 Warranty
Section 23 05 00 - Basic HVAC Requirements - Execution and Closeout Requirements.

Provide a five-year manufacturer warranty to include coverage for refrigeration compressors, evaporator, and condenser coils.

B Materials

B.1 Manufacturers

Packaged Terminal Air Conditioning Units:

a. Trane
b. Carrier Corporation
c. General Electric
d. McQuay International
e. Substitutions: Section 23 05 00 – Basic HVAC Requirements

B.2 Air Conditioning Units

Description: Packaged, self-contained, through-the-wall air cooled terminal air conditioning units, with wall sleeve, room cabinet, electric refrigeration system, electric heating, outside air louvers, built-in temperature controls; fully charged with refrigerant and filled with oil.

B.3 Cabinet

Cabinet: Wall mounted of galvanized steel with baked enamel finish, removable front panel with concealed latches, and color as selected by architect.

Discharge Grille and Access Door: Removable discharge grilles allowing 4-way discharge air pattern, with hinged door in top of cabinet for access to controls.

B.4 Wall Sleeves and Louvers

Wall Sleeves: Galvanized steel with protective mastic coating polyester finish.

B.5 Chassis

Refrigeration System:

a. Direct expansion cooling coil.
b. Hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection.
c. Condenser coil and fan.

Air System: Centrifugal forward curved evaporator fans with two speed permanent split capacitor motor, permanent washable filters, positive pressure ventilation damper with concealed manual operator.

Heating Coil: Electric.

Condensate Drain: Drain pan to direct condensate to condenser coil for re-evaporation.

Condenser Fan.

B.6 Unit Electrical and Controls

Units shall have electrical characteristics as indicated on the equipment schedule, and shall allow either aluminum or copper main conductors to be connected to terminal block connections.

Unit shall include a pushbutton OFF/FAN/HEAT/COOL selector switch, remote mounted control thermostat, VENT OPEN/CLOSE and FAN CYCLE switches. Safeties shall include automatic reset overtemperature and overcorrect protection for the compressor, inherent automatic reset overtemperature protection for fan motor and 2 overtemperature protectors for heater.

All control equipment shall be factory installed and prewired including all starters, relays, safety switches, etc.

C Construction
C.1 Installation
Install in accordance to manufacturer's instructions.

Coordinate installation of units with architectural, structural, mechanical, and electrical work.

Protect finish from damage during construction.

Coordinate wall opening locations and sizes with other sections of work requiring such information.

Units shall be securely supported from building construction by supports directly attached to unit casing.

79. Split System Air Conditioning Units, Section 23 81 28.

A Description
A.1 Summary
This section contains specifications for split system air conditioning units for this project.

Related Sections
a. Applicable provisions of Section 23 05 00 govern work under this section.
b. Section 23 05 00 – Basic HVAC Requirements.
c. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
d. Section 23 09 93 – Sequence of Operations for HVAC Controls.

A.2 Reference Standards
Air-Conditioning and Refrigeration Institute (ARI)
a. ARI 210 – Unitary Air-Conditioning and Air-Source Heat Pump Equipment

Underwriters Laboratories, Inc. (UL)

A.3 Design Criteria
Units shall be certified in accordance to ARI Standard 210.

Units and remote electrically powered components shall contain a unit mounted, factory prewired terminal block. Electrical components shall be U.L. tested, and U.L. labeled.

The units (except for power and control wiring to remote condensing units, thermostats and other specialty control interlocking) shall be factory prewired within the unit cabinet and shall meet national, state and local codes. Wiring shall be numbered and connected to a numbered wiring terminal.

The entire split system air conditioning unit shall be furnished and installed with components and accessories required for a fully functional system. Verify field piping requirements with the Manufacturer.

A.4 Shop Drawings
Submit shop drawings for equipment specified under this section. Include data concerning sizes, dimensions, weights, heating capacities, materials of construction, ratings, electrical data, wiring diagrams, refrigerant piping diagrams, controls, options and manufacturer;s installation requirements, instructions and recommendations.

The manufacturer's shop drawing submittal shall include complete component descriptive literature, detailed electrical wiring and refrigerant piping diagrams and drawings that have been specifically prepared for this project.

B Materials
B.1 Manufacturers
Mitsubishi
Friedrich
Carrier
Substitutions: In accordance to Section 23 05 00 – Basic HVAC Requirements.

B.2 Indoor Unit
Steel frame and cabinet with neutral color, furniture quality exposed exterior panels; removable exterior panels for access for servicing, and built-in air in intake and discharge louvers. Unit shall include permanent, washable air filters. Filters shall be easily removable for cleaning.

Fans shall be vibration isolated, direct drive type.

Unit evaporator coil shall have copper tubes, with aluminum fins, refrigerant distributor, and a condensate drain pan with built-in condensate pump capable of providing a 10-foot lift for condensate removal.

B.3 Outdoor Unit
Air-cooled, remote mounting, compressor-condensing unit.

Unit cabinet shall be zinc, or similarly coated with a corrosion resistant coating and have removable panels for service access.

Compressor shall be high efficiency, hermetic type with thermal overloads. Compressor shall have vibration isolators to keep sound to a minimum.

Condenser coil shall have copper tubes with aluminum fins.

Condenser fan shall be propeller type, with a totally enclosed, direct drive fan motor.

Condenser low ambient capacity control shall be capable of providing continuous unit cooling capability down to 0 degrees F ambient outside temperature.

Outdoor unit shall contain a full charge of refrigerant and oil for the entire system.

Refrigeration system shall include external service valves on the outdoor unit for unit servicing, and a factory supplied, pre-insulated liquid and suction line kit for field installation.

B.4 Unit Electrical and Controls

Units shall be complete with motor starters, relays, and control thermostat. Indoor unit fan shall have fan speed controller to allow for fan speed selection from three speeds.

Units shall have single point electrical connection (on each section) with electrical characteristics as specified on the equipment schedule, and shall allow either aluminum or copper main conductors to be connected to terminal block power connections.

Control thermostat shall be electronic, seven day programmable type with LCD display, auto-changeover control, set-up and set-back schedules, built-in compressor time delay and battery back-up.

C Construction

C.1 General

The entire system and components shall be installed and operated in strict accordance with the Manufacturer's instructions and recommendations.

Both the indoor and outdoor sections shall be mounted level.

a. Indoor Unit
    i. Suspend the indoor unit from the building structure with hanger rods and spring vibration isolators.
    ii. Extend cooling coil condensate drain line from the unit condensate connection to the nearest clear water waste drain location.
    iii. Adjust the unit fan speed to provide proper unit operation, or as specified.
b. Outdoor Unit
    i. Furnish a weatherproof fusible electrical disconnect switch with fuses to disconnect all electrical power to outside units.
    ii. Outdoor units shall be mounted on the roof on roof rail supports.

Start-Up

a. Three copies of a written service report shall be submitted to the engineer following the initial start-up. It shall be signed by the serviceman responsible for performing the startup and adjustment work. It shall indicate that installation is compete, indicate readings taken, and shall state that the unit has been placed in proper running condition as recommended by the unit manufacturer and within the intent of the Contract Documents.

80. Electric Heating Terminal Units, Section 23 82 01.

A Description

A.1 Summary

Section Includes:

a. Electric Wall Heaters

Related Sections:

a. Applicable provisions of Section 23 05 00 – Basic HVAC Requirements shall govern all work under this Section.
b. Section 23 05 00 – Basic HVAC Requirements.
c. Section 23 36 00 - Air Duct Accessories

A.2 References

Air-Conditioning and Refrigeration Institute (ARI)

a. ARI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.

Underwriters Laboratories, Inc. (UL)

A.3 Submittals

Section 23 05 00 – Basic HVAC Requirements – Shop drawings, product data and samples.

Include dimensions, capacities, materials of construction, ratings, weights, wiring diagrams, and appropriate identification for all equipment in this section. Include color selection chart where applicable.

A.4 Design Criteria

Forced Circulation Coils: Ratings certified in accordance to ARI 410.

Electrical Equipment and heaters shall be UL listed for the service specified.

Electrical components and work must be in accordance to National Electrical Code.

B Materials

B.1 Electric Wall Heaters

Manufacturers:

a. Berko
b. Q-Mark
c. Markel Products Company

d. Trane Division American Standard
e. Or approved equal.

Use corrosion resistant heating elements, designed and spaced for even distribution of air across the heating element, and installed to prevent noise of expansion and contraction.

Provide units with necessary overheat protection, reset devices, air flow interlock switch, contactors, transformers, local non-fused disconnect switch that is prewired, integral concealed adjustable thermostat, and other controls as may be required by codes.

Fan powered units shall be provided with thermostat and controls to maintain fan operation until residual heat in the heating elements has been dissipated. The fans and motors shall be balanced and mounted for vibration free operation.

Corrosion resistant 18 gauge steel for surface or recessed mounting as specified with louvered front panel with baked on enamel satin finish or anodized aluminum trim frame with anodized aluminum louvered front panel.

C Construction

C.1 Installation

Install units in accordance to manufacturer's installation instructions.

Protect finished surfaces from damages during construction.

Coordinate location of units with other trades to assure correct recess size for recessed units.

Provide required line and low voltage control wiring.

After installation, provide protective covers to prevent accumulation of dirt on units during balance of construction.

Power line voltage wiring will be by electrical contractor.

C.2 Electric Wall Heaters

Install units at locations as specified on the drawings and as detailed.

The bottom of the heaters shall be mounted approximately 8 inches above the finished floor line. Securely mount the unit enclosure to the wall at the locations shown, except that due consideration and coordination shall be given to interferences with other construction.

Units shall be recessed or surface mounted as specified on the Drawing schedule.

81. Electrical Work, Item SPV.0105.39.

A Description

This general provision describes all electrical work as shown on the plans, provided in the contract and as described in the applicable sections of the following general articles:

a. Basic Electrical Requirements Section 26 00 00
b. Minor Electrical Demolition and Alterations Section 26 05 01
c. Building Wire and Cable Section 26 05 19
d. Grounding and Bonding Section 26 05 26
e. Electrical Hangers and Supports Section 26 05 29
f. Raceway and Boxes Section 26 05 33
g. Electrical Identification Section 26 05 53
h. Short Circuit/Coordination/Arc Flash Hazard Analysis Studies Section 26 05 73
i. Electrical Utility Services Section 26 07 00
j. Dry Type Transformers Section 26 22 00
k. Panelboards Section 26 24 16
l. Wiring Devices Section 26 27 26
m. Fuses Section 26 28 13
n. Enclosed Switches Section 26 28 19
o. Transient Voltage Surge Suppressor Section 26 35 53
p. Luminaires, Lighting Controls and Emergency Lighting Inverter Section 26 51 00
q. Public Address System, Section 27 51 00
r. Fire Detection and Alarm System, Section 28 31 00

B Materials

All materials shall conform to the applicable sections of the following general articles:

a. Basic Electrical Requirements Section 26 00 00
b. Minor Electrical Demolition and Alterations Section 26 05 01
c. Building Wire and Cable Section 26 05 19
d. Grounding and Bonding Section 26 05 26
e. Electrical Hangers and Supports Section 26 05 29
f. Raceway and Boxes Section 26 05 33
g. Electrical Identification Section 26 05 53
h. Short Circuit/Coordination/Arc Flash Hazard Analysis Studies Section 26 05 73
i. Electrical Utility Services Section 26 07 00
j. Dry Type Transformers Section 26 22 00
k. Panelboards Section 26 24 16
l. Wiring Devices Section 26 27 26
m. Fuses Section 26 28 13
n. Enclosed Switches Section 26 28 19
o. Transient Voltage Surge Suppressor Section 26 35 53
p. Luminaires, Lighting Controls and Emergency Lighting Inverter Section 26 51 00
q. Public Address System, Section 27 51 00
r. Fire Detection and Alarm System, Section 28 31 00

C Construction

All construction shall conform to the applicable sections of the following general articles:

a. Basic Electrical Requirements Section 26 00 00
b. Minor Electrical Demolition and Alterations Section 26 05 01
c. Building Wire and Cable Section 26 05 19
d. Grounding and Bonding Section 26 05 26
e. Electrical Hangers and Supports Section 26 05 29
f. Raceway and Boxes Section 26 05 33
g. Electrical Identification Section 26 05 53
h. Short Circuit/Coordination/Arc Flash Hazard Analysis Studies Section 26 05 73
i. Electrical Utility Services Section 26 07 00
j. Dry Type Transformers Section 26 22 00
k. Panelboards Section 26 24 16
l. Wiring Devices Section 26 27 26
m. Fuses Section 26 28 13
n. Enclosed Switches Section 26 28 19
o. Transient Voltage Surge Suppressor Section 26 35 53
p. Luminaires, Lighting Controls and Emergency Lighting Inverter Section 26 51 00
q. Public Address System, Section 27 51 00
r. Fire Detection and Alarm System, Section 28 31 00

D Measurement

The department will measure Electrical Work as a single lump sum unit of work for all electrical 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.0105.39	Electrical Work	LS

Payment is full compensation for furnishing and installing all electrical work as per the plans, details, and the following general articles: Basic Electrical Requirements Section 26 00 00, Minor Electrical Demolition and Alterations Section 26 05 01, Building Wire and Cable Section 26 05 19, Grounding and Bonding Section 26 05 26, Electrical Hangers and Supports Section 26 05 29, Raceway and Boxes Section 26 05 33, Electrical Identification Section 26 05 53, Short Circuit/Coordination/Arc Flash Hazard Analysis Studies Section 26 05 73, Electrical Utility Services Section 26 07 00, Dry Type Transformers Section 26 22 00, Panelboards Section 26 24 16, Wiring Devices Section 26 27 26, Fuses Section 26 28 13, Enclosed Switches Section 26 28 19, Transient Voltage Surge Suppressor Section 26 35 53, Luminaires, Lighting Controls and Emergency Lighting Inverter Section 26 51 00, Public Address System, Section 27 51 00, Fire Detection and Alarm System, Section 28 31 00; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work

82. Basic Electrical Requirements, Section 26 00 00.

A Description

A.1 Summary

Section Includes:

a. General Electrical Requirements
b. Work Included in Contract
c. Definitions
d. Dimensions and Equipment Location
e. Owner Supplied Products
f. Work by Owner
g. Pre-Installation Meetings
h. Demonstration and Training Meetings
i. Product Data
j. Shop Drawings
k. Test Reports
l. Manufacturer's Certificates
m. Manufacturer's Instructions
n. Manufacturer's Field Reports
o. Quality Assurance and Control of Installation
p. Temporary Facilities and Controls
q. Delivery, Storage, and Handling Requirements
r. Product Options
s. Product Substitution Procedures
t. Final Cleaning and Painting
u. Starting of Systems
v. Demonstration and Instructions
w. Project Record Documents
x. Extra Material and Spare Parts
y. Operation and Maintenance Manuals
z. Warranties
aa. Identification
bb. Pre-bid Survey

A.2 General Electrical Requirements

Mention of any article, operation or method requires that contractor shall provide same and perform each operation in complete accordance with conditions stated.

Contractor shall provide all material, labor, equipment and transportation as necessary to complete project in compliance with contract documents.

In general, this work includes everything essential for a complete electrical system in operating order as shown on drawings and indicated in specifications.

Work shall be installed in accordance to National, State, and Local codes, ordinances, laws, and regulations. Comply with all applicable OSHA regulations.

Materials shall have a UL or ETL label where a UL or ETL standard or testing requirement exists.

All work shall be installed in accordance to all State and Local Inspection Authorities having jurisdiction together with recommendations of manufacturer whose equipment is to be supplied and installed under this contract.

Before submitting a bid, each bidder shall examine all specifications and drawings relating to their work and shall become fully informed as to extent and character of work required and its relation to other work within project area.

Contractor, in conjunction with engineer's representative, shall establish exact locations of all materials and equipment to be installed.

Consideration shall be given to construction features, equipment of other trades and requirements of equipment proper.

All materials shall be suitably stored and protected prior to installation and all work shall be protected after installation, during construction and prior to acceptance.

Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of all equipment and apparatus required to be installed by contractor.

All such equipment shall be removed by contractor upon completion of project.

A.3 Work Included in Contract
Contractor shall provide auxiliary contacts, buttons, and switches on starters as required.

Contractor shall provide power wiring (120 V or greater) to control panels, motor starters, variable frequency drives, motors, electric actuators, electric devices and smoke detectors.

A.4 Definitions
Exposed: Exposed to view in any room, corridor or stairway.

Code: National, State and Local Electrical codes including OSHA requirements.

Signal Voltage: NEC class 1, 2, or 3 remote control, signaling, or power limited circuits.

Low Voltage: 50 to 600 volts.

Medium Voltage: 601 to 35,000 volts.

High Voltage: 35,001 volts and greater.

Electrical Ductbank: Assembly consisting of electrical conduits encased in concrete.

A.5 Dimensions and Equipment Location

Drawings depicting electric work are diagrammatic and show, in their approximate location, symbols representing electrical equipment and devices.

Exact locations of such equipment and devices shall be established in field in accordance to instructions from engineer/architect as established by manufacturer's installation drawings and details.

a. Contractor shall refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.
b. Unless specifically stated, no measurement of an electric drawing derived by scaling shall be used as a dimension to work by.
c. Dimensions noted on electric drawings are subject to measurements of adjacent and previously completed work.
d. All measurements shall be performed prior to actual installation of equipment.

A.6 Pre-Installation Meetings

When required in individual specification sections, convene pre-installation meeting at Project site prior to commencing work of specific section.

Require attendance of parties directly affecting, or affected by, work of specific section.

Notify engineer/architect four days in advance of meeting date.

Prepare agenda and preside at meeting:

a. Review conditions of installation, preparation and installation procedures.
b. Review coordination with related work.

Record minutes and distribute copies within two days after meeting to participants, with two copies to engineer/architect, and those affected by decisions made.

A.7 Demonstration and Training Meeting

Contractor shall schedule and administer demonstration and training sessions for owner for each portion of equipment and products that are required to have training in proper operation and maintenance.

Contractor shall schedule representatives of the equipment manufacturer to attend demonstration and training sessions to provide additional information as necessary.

A.8 Product Data

Product Data: Submit to engineer/architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

Submit number of copies contractor requires, plus three copies engineer/architect will retain.

Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

A.9 Shop Drawings

Shop Drawings: Submit to engineer/architect for review for limited purpose of checking for conformance with information given and design concept expressed in contract documents.

Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

Shop drawings shall be submitted in advance of construction and installation so as to not cause delay in other contractor's work.

Data submitted for engineer's review shall be numbered consecutively, shall be noted to correlate with electrical drawings and shall bear:

a. Name and location of project.
b. Name of contractor.
c. Date of submittal.
d. Date of drawings and date of each correction and revision.
e. If more than one type of lighting fixture (or other material) is on submitted sheet, proposed equipment shall be conspicuously checked with red pen by electrical contractor.

Shop drawings for different systems and equipment shall, be bound separately by specification section and not bound by manufacturer.

Submittals which contain different specification section systems bound together shall be returned not reviewed and returned to contractor for re-submittal.

Lighting Fixture shop drawings shall consist of single submittal with all project light fixtures included. Submittals grouped by manufacturer shall not be accepted. Contractor shall be responsible for coordinating drawings from his various suppliers in order to comply with this requirement.

Contractor shall examine shop drawings and equipment brochures prior to submission.

Contractor shall verify that materials and equipment depicted will properly fit into construction.

Contractor shall also review all previously completed work related to installation of equipment depicted to ensure that it has been properly installed.

No materials or equipment subject to prior review by engineer shall be fabricated or installed by contractor, without approval.

Engineer's review of shop drawings shall not relieve contractor of responsibility for deviations from requirements of drawings and specifications, unless prior approval for such deviations has been granted.

Submit number of opaque reproductions contractor requires, plus three copies engineer/architect will retain.

After review, contractor shall reproduce and distribute three copies to engineer/architect.

A.10 Test Reports

Operation of equipment and electrical systems does not constitute an acceptance of work by owner.

Final acceptance is to be made after contractor has adjusted their equipment and demonstrated that it meets or exceeds requirements of drawings and specifications.

After work is completed and prior to acceptance, contractor shall conduct following tests, tabulate data, date, sign and submit to engineer:

a. Standard megger insulation test on each feeder.
b. Ground resistance test.
c. Clamp ammeter test on each feeder conductor with all utilization equipment energized.
d. Load current in each phase conductor of feeder or portion thereof supplying panel shall not differ from average connected load currents in feeder conductors by more than 7-1/2 percent.
e. If load current does differ by more than 7-1/2 percent, contractor shall change phase loading to same or receive written approval from engineer that this is not required due to nature of load.

Upon completion of installation, contractor shall furnish certificates of approval from authorities having jurisdiction.

Contractor shall demonstrate that all work is complete and is in specified operating condition, with raceway and conduit system properly grounded, wiring free from grounds, shorts, and entire installation is free from any physical defects.

In presence of engineer and owner, contractor shall demonstrate proper operation of all systems.

Perform other testing as specifically directed in other sections of specifications for specific equipment.

A.11 Manufacturer's Certificates
When specified in individual specification sections, submit certification by manufacturer, installation/ application subcontractor, or contractor to engineer/architect, in quantities specified for product data.

Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

Certificates may be recent or previous test results on material or product, but must be acceptable to engineer/architect.

A.12 Manufacturer's Instructions
When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to engineer for delivery to owner in quantities specified for product data.

Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

A.13 Manufacturer's Field Reports
Submit reports for engineer's benefit as contract administrator or for owner.

Submit report in duplicate within 30 days of observation to engineer/architect for information.

Submit for information for limited purpose of assessing conformance with information given and design concept expressed in contract documents.

A.14 Quality Assurance/Control of Installation
Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality.

Comply fully with manufacturer's instructions, including each step in sequence.

Should manufacturer's instructions conflict with contract documents, request clarification from engineer/architect before proceeding.

Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

Perform work by persons qualified to produce workmanship of specified quality.

Verify field measurements are as indicated on shop drawings or as instructed by manufacturer.

Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

A.15 Product Delivery, Storage and Handling Requirements
Transport and handle products in accordance to manufacturer's instructions.

Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

Store and protect products in accordance to manufacturer's instructions.

Store with seals and labels intact and legible.

Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

For exterior storage of fabricated products, place on sloped supports above ground.

Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

A.16 Product Options
Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications; no options or substitutions allowed.

Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance to following article.

Materials and equipment required shall be of new manufacture.

Items specified shall be of latest type or model produced by manufacturer specified. If model number is obsolete, substitute current manufacturer's product.

A.17 Product Substitution Procedures

Substitutions may be considered when a product becomes unavailable through no fault of contractor.

Document each request with complete data substantiating compliance of proposed substitution with contract documents.

A request constitutes a representation that contractor:

a. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
b. Will provide same warranty for Substitution as for specified product.
c. Will coordinate installation and make changes to other work that may be required for the work to be complete with no additional cost to owner.
d. Waives claims for additional costs or time extension that may subsequently become apparent.
e. Will reimburse owner and engineer/architect for review or redesign services associated with re-approval by authorities having jurisdiction.

Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals, without separate written request, or when acceptance will require revision to contract documents.

Substitution Submittal Procedure:

a. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
b. Submit shop drawings, product data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
c. Lighting Fixtures: Request for substitutions shall include photometric test reports performed by an independent testing laboratory.
d. Contractor shall provide samples of proposed equipment for engineer's review, if requested by engineer.
e. Contractor shall furnish any other information or materials as requested by engineer to establish equality.
f. Engineer will notify contractor in writing of decision to accept or reject request.

Contractor's submitting equipment for approval as an equal, shall include in their bid all incidental costs that may result from use of approved equipment.

Such costs shall include, but not be limited to, additional costs that may be incurred by other contractors whose scope of work is affected by use of "equal" products.

Electrical contractor shall be responsible for those costs even if they do not become evident until after bidding.

Only one request for substitution will be considered for each product.

When substitution is not accepted, provide specified product.

A.18 Final Cleaning and Painting
Rubbish resulting from work shall be removed and disposed of on a daily basis in such manner as to be acceptable to architect.

Contractor shall clean all exposed iron work, interior and exterior of cabinets and pull boxes, etc., and remove rubbish and debris resulting from work.

Where painted surfaces of equipment have been damaged or rusted during construction, contractor shall paint same to match final.

Clean other equipment as indicated in other sections of specification for specific equipment.

A.19 Starting of Systems
Coordinate schedule for start-up of various equipment and systems.

Notify engineer/architect and owner seven days prior to start-up of each item.

Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

Verify wiring and support components for equipment are complete and tested.

Execute start-up under supervision of applicable manufacturer's representative in accordance to manufacturer's instructions.

When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

A.20 Demonstration and Instructions
Demonstrate operation and maintenance of products to owner's personnel two weeks prior to date of Substantial Completion.

A.21 Project Record Documents
Maintain on site one set of following electrical record documents; record actual revisions to the work:

a. Locations of all buried conduit or similar items. Include buried depth.
b. Field changes of dimension or detail.
c. Changes made by field order or change order.
d. Details not on original contract drawings.
e. Changes to circuit numbers.
f. Junction box locations and conduit runs, with trade sizes indicated, for all lighting, power, and electrical systems installed.
g. Record documents include:
    i. Drawings.
    ii. Specifications.
    iii. Addenda.
    iv. Change orders and other modifications to the contract.
    v. Reviewed shop drawings, product data, and samples.
    vi. Manufacturer's instruction for assembly, installation, and adjusting.

Ensure entries are complete and accurate, enabling future reference by owner.

Store record documents separate from documents used for construction.

Record information concurrent with construction progress, not less than weekly.

Specifications: Legibly mark and record at each product section description of actual products installed, including following:

a. Manufacturer's name and product model and serial number.
b. Product substitutions or alternates utilized.
c. Changes made by addenda and modifications.

Record drawings and shop drawings: Legibly mark each item to record actual construction including:

a. Measured depths of foundations in relation to finish main floor datum.
b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
d. Field changes of dimension and detail.
e. Details not on original contract drawings.

Submit documents to engineer/architect for review.

A.22 Extra Material and Spare Parts

Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

Deliver to Project site and place in location as directed by owner; obtain receipt prior to final payment.

A.23 Operation and Maintenance Manuals

Electrical contractor shall assemble and submit to architect for subsequent submission to owner, three complete sets of a Manual of Operation and Maintenance for each of electrical and communications systems.

Each manual shall consist of a 3-ring binder volume instructing owner's personnel in operation and maintenance of system in question.

All information shall be bound and secured in manual.

Manual shall cover all phases of operation of equipment and shall be illustrated with photographs, drawings, and wiring diagrams.

Manuals shall accurately describe operation, construction and adjustable features of complete system and its component parts.

Manual shall be complete with an equipment parts listing to facilitate ordering of spare and replacement parts.

Each manual shall contain two sets of final shop drawings depicting equipment as installed.

A.24 Warranties

Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

Verify documents are in proper form, contain full information, and are notarized.

Co-execute submittals when required.

Include table of contents and assemble in three D side ring heavy duty binder with durable plastic cover.

Time of Submittals:

a. For equipment or component parts of equipment put into service during construction with owner’s permission, submit documents within ten days after acceptance.
b. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.

c. For items of work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

A.25 PreBid Survey

Before submitting their bid, contractor shall tour project site and review following items:

a. Exact Configuration of areas requiring demolition, temporary power, relocating, etc.
b. Site conditions such as material storage, staging areas, parking, etc.
c. Problems with work sequence.

Any conditions found that are not shown on drawings or stated within project manual that may affect scope of work shall be reported to engineer.

B Materials

B.1 Firestopping

Firestopping materials shall include, but not be limited to, mortars, sealants and caulks, putties, collars, intumescent wrap strips mastics, and firestop pillows. Materials and methods used shall be recognized by an independent testing agency and shall have flame and temperature ratings assigned by specific agency.

Materials using solvents or those requiring hazardous waste disposal shall not be used.

Firestop assemblies shall meet fire test and hose stream test requirements of independent testing agency;

a. Acceptable Manufacturers:
    i. 3M Corporation
    ii. Rectorseal Corporation

B.2 Sleeves

Sleeves: ASTM A53, Schedule 40 galvanized steel pipe.

B.3 Access Panels

Access panels required by code or otherwise to electrical service equipment shall be supplied and installed by electrical contractor.

C Construction

C.1 Firestopping

Openings in fire rated construction and annular spaces around conduits, cable trays, and other penetrating items shall be protected in accordance to NEC article 300-21 and in accordance to Wisconsin Administrative Code, Department of Commerce Chapter 51.049. Fire rating of protective seal shall be at least that of floor or wall into which it is installed, so that original fire rating of construction is maintained.

Wall or floor penetration openings shall be as small as possible.

Openings and annular spaces required by code to be protected shall be protected.

Installation of materials and assemblies shall be in strict accordance with manufacturer's instructions.

C.2 Sleeves
Where conduits, cables trays, or other electrical raceways must pass through floors or walls that are to be constructed of poured in place concrete, contractor shall provide sleeves in formwork prior to concrete pour. It shall be electrical contractor's responsibility to provide all sleeves for his work unless specifically indicated otherwise on drawings. Prior to installing sleeves, contractor shall prepare drawings indicating locations, quantities, sizes, and spacing's of all sleeves anticipated. Drawings shall be forwarded to structural engineer for approval.

Floor sleeves shall extend minimum of 2 inches above finished floor.

83. Minor Electrical Demolition and Alterations, Section 26 05 01.

A Description
A.1 Summary
Section Includes:

a. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled.
b. Removal of designated construction; dismantling, cutting and alterations for completion of work.
c. Disposal of materials.
d. Storage of removed materials.
e. Identification of utilities.
f. Salvaged items.
g. Protection of items to remain as indicated on drawings.
h. Relocate existing equipment to accommodate construction.

Related Sections:

a. Applicable provisions of Section 26 00 00 shall govern all work under this section.
b. Section 26 00 00 – Basic Electrical Requirements.

A.2 Closeout Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

Section 26 00 00 – Basic Electrical Requirements: Record actual locations of capped utilities conduits and equipment abandoned in place.

A.3 Quality Assurance
Contractor shall notify the engineer of any existing code violations observed during the course of performing his work. The engineer will decide if corrective action needs to be

taken. Corrective actions that change the scope of the work will be considered a change order and will be processed accordingly.

A.4 Scheduling
Existing buildings shall remain in service during construction.

Prior to demolition or alteration of structures, the following shall be accomplished:

a. Owner release of such structure.
b. Disconnection of electrical power to equipment and circuits removed or affected by demolition work.
c. Electrical services rerouted or shut off outside area of demolition.
d. Coordinate sequencing with owner and other contractors.
e. Survey and record condition of existing facilities to remain in place that may be affected by demolition operations.

Power outages and interruptions in building systems shall be held to a minimum and shall be done at a time convenient to owner. Time of all outages shall be scheduled with owner and all other trades affected by outage at least ten working days in advance.

Cease operations immediately when structure appears to be in danger and notify architect/engineer. Do not resume operations until directed.

A.5 Coordination
Conduct demolition to minimize interference with adjacent and occupied building areas.

Coordinate demolition work with owner.

Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

Shut-down Periods:

a. Arrange timing of shut-down periods of in service panels with owner. Do not shut down any utility without prior written approval.
b. Keep shut-down period to minimum or use intermittent period as directed by owner.
c. Maintain life-safety systems in full operation in occupied facilities.

Identify salvage items in cooperation with owner. Owner may keep any equipment in demolition areas. Contractor shall deliver equipment owner wants salvaged to area in building designated by owner. Contractor shall remove all materials in demolished area not salvaged from site. Contractor shall obtain release of all materials before disposition.

After demolition operations are completed, survey conditions and restore existing facilities to their pre-demolition condition.

B (Vacant)

C Construction

C.1 Examination

Verify of existing conditions before starting work.

Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

Verify termination points for demolished services.

C.2 Preparation

Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of public, owner, contractor's employees, and existing improvements to remain.

Temporary egress signage and emergency lighting.

C.3 Demolition

Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to architect/engineer before disturbing existing installation.

Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

Reconnect equipment being disturbed by renovation work and required for continued service to or nearest available panel.

Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.

Install temporary wiring and connections to maintain existing systems in service during construction.

Perform work on energized equipment or circuits with experienced and trained personnel.

Remove, relocate, and extend existing installations to accommodate new construction.

Repair adjacent construction and finishes damaged during demolition and extension work.

Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.

Clean and repair existing equipment to remain or to be reinstalled.

Protect and retain power to existing active equipment remaining.

Electrical equipment in conflict with construction shall be removed or relocated as indicated on drawings, as directed, or required.

C.4 Modifications
Feeders, branch circuits, and other system wiring which are to remain in service but which are presently routed through areas being demolished shall be rerouted around demolition area.

Where existing branch circuits are to be extended or modified, existing conduit may be reused at contractor's discretion. Existing wiring may be spliced and used to extent that it was not removed. Any existing conductors removed shall not be re-pulled and then reused.

C.5 Existing Panelboards
Ring out circuits in existing panel affected by the work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.

Tag unused circuits as spare.

Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding project area or are not in use.

Remove existing wire no longer in use from panel to equipment.

Provide new updated directories where more than three circuits have been modified or rewired.

C.6 Salvage Items
Remove and protect items requested by owner to be salvaged and transport to location on site designated by owner.

C.7 Reusable Electrical Equipment
Carefully remove equipment, materials, or fixtures which are to be reused. Only items specifically identified as be reused shall be reused.

Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

Relocate existing lighting fixtures as indicated on drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

C.8 Cleaning
Provide under provisions of Section 26 00 00 – Basic Electrical Requirements.

Remove demolished materials as work progresses. Legally dispose materials.

Keep workplace neat.

C.9 Disposal
Contractor shall tour demolition areas with owner to determine status of all equipment to be removed during demolition.

All equipment that is to be salvaged for reuse by the owner shall be removed by contractor and transported to an owner designated storage area on site.

Raceway, boxes and supporting devices shall become property of contractor and shall be removed from site and disposed of by the contractor.

Removed equipment shall be disposed of by contractor unless specifically otherwise indicated on drawings or requested by owner. Contractor shall provide transport for disposal.

C.10 Lighting Fixture Ballast Disposal
Contractor shall inspect all ballasts in all light fixtures removed as part of this project and take actions described below.

All ballasts labeled as "NON PCB'S" or "NO PCB'S" shall be handled as described in other sections of these specifications which describe demolition or salvage materials handling. If PCB content is not stated on ballast label, ballast shall be handled as a PCB ballast.

All PCB ballasts shall have wires clipped off and ballasts placed in US DOT approved type 17C or type 17H barrels and placed in storage in a location within building as designated by owner. Contractor shall provide to owner, in typewritten form, a total count of these ballasts and where they are stored.

These ballasts are not to be removed from work site by contractor.

Contractor shall label and mark PCB storage barrels with EPA approved PCB labels and shall mark storage area with signs, marks, and lines to meet regulations of Wisconsin Code NR 157.

Contractor shall provide approved PCB absorbent materials to be stored immediately adjacent to barrel storage area. Do not place loose absorbent material in barrels.

When ballast demolition is completed and all PCB ballasts are placed in barrels ready to be picked up for disposal, contractor shall notify owner in writing so owner can make arrangements for pick up and disposal of PCB ballasts.

C.11 Lighting Fixture Lamp Disposal
Contractor shall be responsible for proper removal and recycling of all existing fixture lamps being removed from service in accordance to EPA and State of Wisconsin DNR requirements. Lamps shall not be disposed of in any way except as described herein.

Contractor shall be responsible for arranging for recycling of lamps by a licensed waste lamp and bulb recycler. Cost for recycling of removed lamps shall be included in contractor's bid.

Contractor shall carefully package removed lamps to prevent breakage. Contractor shall store waste lamps in a secure area, either in container that lamps are shipped in or in other ways so as to eliminate breakage. Both lamp storage area and individual containers should be labeled as hazardous waste. Store lamps in covered containers to prevent lamps from being broken as a result of other debris being placed on top of them.

C.12 Alterations
Contractor shall be responsible for coordination of other trades to facilitate installation in existing building.

Work shall include, but is not limited to, cutting, patching, refinishing and all work necessary and required to leave existing building in a condition acceptable to engineer.

C.13 Protection of Finished Work
Furnish under provisions of Section 26 00 00 – Basic Electrical Requirements.

84. Building Wire and Cable, Section 26 05 19.

A Description
A.1 Summary
Section Includes:

a. Building Wire
b. Building Cable
c. Wiring Connectors
d. Connections

Related Sections:

a. Applicable provisions of Section 26 00 00 shall govern all work under this section.
b. Section 26 00 00 – Basic Electrical Requirements.

A.2 References
International Electrical Testing Association (NETA):

a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

National Fire Protection Association (NFPA):

a. NFPA 70 - National Electrical Code (NEC)

A.3 Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data: Submit for building wire and each cable assembly type.

Samples:

a. Select each length to include complete set of manufacturer markings.
b. Attach tag indicating cable size and application information.

Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

Test Reports: Indicate procedures and values obtained.

A.4 Closeout Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Project Record Documents: Record actual locations of components and circuits.

A.5 Qualifications
Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years.

A.6 Field Measurements
Verify field measurements are as indicated on drawings.

A.7 Coordination
Section 26 00 00 – Basic Electrical Requirements: Requirements for coordination.

When wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 feet of length shown.

B Materials
B.1 Building Wire
Product Description: Single conductor insulated wire.

Conductor: Copper only.

Insulation Voltage Rating: 600 volts, rated 75 degrees C unless otherwise noted.

In mechanical rooms, light fixtures, and others high temperature applications, insulation shall be rated 90 degrees C. or greater.

Provide following wiring types:

a. Concealed or exposed dry interior locations: Use only building wire Type THHN/THWN or XHHW insulation in raceway.
b. Above Accessible Ceilings: Use only building wire Type THHN/THWN or XHHW insulation in raceway.
c. Wet or Damp Interior Locations: Use only building wire Type XHHW-2 insulation in raceway.
d. Exterior Locations: Use only building wire Type XHHW-2 insulation in raceway.
e. Underground Locations: Use only building wire Type XHHW-2 or USE insulation, in raceway.

Solid or Stranded conductor for 10 AWG and smaller. Conductor 8 AWG and larger shall be stranded.

Conductor not smaller than 12 AWG for power and lighting circuits.

Conductor not smaller than 14 AWG for control circuits.

All wires shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer’s stock.

B.2 Wiring Connectors

Conductors No. 10 AWG and Smaller: Scotch 3M - Scotch-lok compression type solderless connectors with plastic cover.

Joints, Taps, and Splices in Conductors No. 8 AWG and Larger: Solderless compression type connectors, tool and die applied, of a type that will not loosen under vibration or normal strains. Burndy "Hy-Dent" type or equivalent.

Rubber insulating electrical tape: Scotch 3M model 23, 30-mil tape.

Split bolt connectors are not acceptable.

C Construction

C.1 Examination

Install in accordance to manufacturer's written instructions and in accordance to recognized industry practices.

Run wire and cable in conduit, unless otherwise indicated on drawings.

Do not draw conductors into conduits until building is enclosed and watertight and until work that may cause conductor damage has been completed.

Voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of NEC Article 215.

Examine areas and conditions under which conductors are to be installed and notify engineer in writing of conditions detrimental to proper and timely completion of work.

Do not proceed with work until unsatisfactory conditions have been corrected.

C.2 Joints, Taps and Splices
Each tap, joint, or splice in conductors No. 8 AWG and larger shall be taped with two half-lap layers of vinyl plastic electrical tape and a finish wrap of color coding tape, where required by code.

Cable splices shall be made only in distribution and junction boxes.

C.3 Preparation
Completely and thoroughly swab raceway before installing wire.

C.4 Existing Work
Remove exposed abandoned wire and cable including abandoned wire and cable above accessible ceiling finishes.

Patch surfaces where removed cables pass through building finishes.

Disconnect abandoned circuits and remove circuit wire and cable.

Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed.

Install blank cover for abandoned boxes not removed.

Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

Extend existing circuits using materials and methods as specified.

For additions to existing buildings, existing conductor color coding schemes shall be followed unless in conflict with codes. If no logical color coding scheme exists, color coding indicated above shall be followed.

C.5 Installation
Route wire and cable to meet project conditions.

Conductors shall not be installed at temperatures below manufacturer's minimum installation temperature.

Neatly train and lace wiring inside boxes, equipment, and panelboards.

Identify and color code wire and cable under provisions of Section 26 05 53 – Electrical Identification.

Identify each conductor with its panel and circuit number or other designation indicated.

Special Techniques - Building Wire in Raceway:
a. Pull conductors into raceway at same time.
b. Install building wire 4 AWG and larger with pulling equipment.

Special Techniques - Wiring Connections:
a. Clean conductor surfaces before installing lugs and connectors.
b. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
c. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
d. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
e. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
f. When 10 AWG and smaller stranded conductors are used install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

C.6 Branch Circuit Conductors
Install branch circuits and switched circuits as required to comply with circuiting, switching, and control functions shown on drawings.

Conductors shall be size 12 AWG minimum, unless otherwise noted, for branch circuit wiring, including motor circuits.
Size 120V branch circuits for length of run on following basis:
a. 0 to 75 ft. run from panelboard to first outlet: No. 12 AWG minimum.
b. 75 to 125 ft. run: increase one wire size, No. 12 AWG becomes No. 10 AWG.
c. 126 to 200 feet run: increase two wire sizes, No. 12 AWG becomes No. 8 AWG.
d. 201 and above: wiring to be sized for 3 percent maximum voltage drop.

Provide individual neutral conductors for branch circuits serving isolated ground receptacles and computer equipment. No common neutrals for these circuits.

Route branch circuits and switch legs as dictated by construction, these specifications, or instruction from engineer.

Size conduit, outlet boxes, and other raceway system components in accordance to NEC requirements as minimum.

Circuit numbers as shown on drawings are for contractor to plan their wiring and for estimating purposes and are not necessarily exact circuit numbers to be used in specific panel for particular load.

Exact circuit numbers for each load are to be selected by contractor at their option.

Balanced load on panelboard bus will be determining factor in arrangement of circuits. Panelboards average load shall not differ from phase to phase by plus or minus 7.5 percent.

Motor and equipment branch wiring.

a. Furnish and install motor circuits in accordance to schedules on drawings and code requirements, from source of supply to associated motor starter, and from starter to motor terminal box, including necessary and required intermediate connections.
b. Conductor and conduit size for motor branch circuits, if shown on drawings, are sized for motor requirement only.
c. Control wiring is not included in conduit sizes shown on drawings.
d. Motors shall have proper conductor sizes as per NEC requirements and nameplate ratings.
e. Contractor shall be responsible for verification of ratings of motors and installing proper branch circuits.
f. Obtain manufacturer's wiring diagrams and shop drawings for equipment requiring electrical connections.
g. Check drawings and specifications of other divisions of work for equipment and work, which shall be included in order to provide a complete electrical installation.
h. Motor connections shall be made by compression type connectors using proper tools and fittings to assure good electrical continuity and low resistance joint.

C.7 Feeder Installation

Install in accordance to manufacturer's written instructions, and in accordance to recognized industry practices.

Extend feeders at full capacity from origin to termination.

Feeder conduits shall contain only those conductors constituting a single feeder circuit.

Where feeder conductors are run in parallel, conductors shall be of same length, same material, circularmil area, insulation type, and terminated in same manner.

Where parallel feeder conductors run in separate raceways, each raceway shall have same physical characteristics.

Feeders shall follow most accessible routes, concealed in construction in finished areas, exposed to minimum temperature gradient and to minimum temperature fluctuation.

Confine feeders to insulated portions of building, unless otherwise specified.

Trapped feeder runs without facilities for continuous drainage are not acceptable.

Feeder conduits shall not be routed in conduit floor slabs or below basement or grade level floor slabs.

Feeder conductors in switchboards, panelboards, pullboxes, gutters, and other open wiring spaces shall be bundled by feeder using plastic tie wraps at intervals not greater than 3 feet on center.

C.8 Fixture Wires

Use conductor with insulation suitable for current, voltage, and temperature to which conductor will be subjected.

Provide minimum No. 12 wire size for conductors supplying power to a single fixture. 600V insulation minimum.

Insulation suitable for operation at 90 degrees C. minimum for lighting fixtures with integral ballast, mogul base sockets, quartz lamps, or otherwise where subject to excessive temperatures.

Fixture wiring shall be continuous wiring system to lampholder or to ballast and from ballast to lampholder.

C.9 Wire Color

For wire sizes 10 AWG and smaller, install wire colors in accordance to following:

a. Black and red for single phase circuits at 120/240 volts.
b. Black, red, and blue for circuits at 120/208 volts single or three phase.
c. Brown, orange, and yellow for circuits at 277/480 volts single or three phase.

For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:

a. Black and red for single phase circuits at 120/240 volts.
b. Black, red, and blue for circuits at 120/208 volts single or three phase.
c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

Feeder Circuit Conductors: Uniquely color code each phase.

Ground Conductors:
a. For 6 AWG and smaller: Green.
b. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

C.10 Field Quality Control
Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

Inspect and test in accordance to NETA ATS, except Section 4.

Perform inspections and tests listed in NETA ATS, Section 7.3.1.

85. Grounding and Bonding, Section 26 05 26.

A Description
A.1 Summary
Section Includes:
a. Rod electrodes
b. Wire
c. Grounding well components
d. Mechanical connectors
e. Exothermic connections

Related Sections:
a. Applicable provisions of Section 26 00 00 shall govern all work under this Section.
b. Section 26 00 00 – Basic Electrical Requirements.
c. Section 26 05 19 - Building Wire and Cable.

A.2 References
Institute of Electrical and Electronics Engineers (IEEE):
a. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
b. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

International Electrical Testing Association (NETA):
a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

National Fire Protection Association (NFPA):

a. NFPA 70 - National Electrical Code.

A.3 System Description

Grounding systems use the following elements as grounding electrodes:

a. Metal underground water pipe
b. Metal building frame
c. Rod electrode

A.4 Design Requirements

Provide all material, labor and incidentals necessary for the completion of this section of the work.

A.5 Performance Requirements

Grounding System Resistance: 5 ohms maximum.

A.6 Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data: Submit data on grounding electrodes and connections.

Test Reports: Indicate overall resistance to ground. Indicate soil conditions when tests were done including when last rain occurred.

A.7 Closeout Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Project Record Documents: Record actual locations of components and grounding electrodes.

A.8 Quality Assurance

Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

Perform work in accordance to National Electric Code and state and local code requirements.

A.9 Qualifications

Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

A.10 Delivery, Storage and Handling

Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.

Accept materials on site in original factory packaging, labeled with manufacturer's identification.

Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

A.11 Coordination
Coordinate complete grounding and bonding of building reinforcing steel prior to concrete placement.

B Materials
B.1 Rod Electrodes
Manufacturers:

a. Galvan Industries/Erico Inc.
b. LTV/Copperweld, Inc.
c. Eritech/Erico, Inc.
d. Lyncole XIT Grounding
e. Harger Lightning and Grounding
f. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements

Product Description:

a. Material: Copper-clad steel
b. Diameter: 3/4 inch
c. Length: 10 feet

Connector: Connector shall be exothermic welded connection unless otherwise noted. Provide U-bolt clamp in ground test wells and where indicated on drawings.

B.2 Wire
Material: Stranded copper. Provide tin plated copper where exposed to corrosive environment.

Connection to Electrodes: 2/0 AWG, minimum size.

Grounding Electrode Conductor: Copper conductor, bare.

Bonding Conductor: Copper conductor, bare.

B.3 Grounding Well Components
Well Pipe: 8 inches NPS (DN200) by 24 inches long fiberglass pipe with belled end.

Well Cover: Fiberglass with legend "GROUND" embossed on cover.

B.4 Mechanical Connectors
Manufacturers:
a. Erico, Inc.
b. ILSCO Corporation
c. O-Z Gedney Co.
d. Thomas & Betts, Electrical
e. Burndy Electric
f. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements

Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

B.5 Exothermic Connections
Manufacturers:
a. Thermoweld
b. Cadweld, Erico, Inc.
c. Harger Lightning Protection
d. Exothermic Welding Co.
e. Thomas & Betts, Electrical
f. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements

Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

C Construction
C.1 Examination
Verify of existing conditions before starting work.

Verify final backfill and compaction has been completed before driving rod electrodes.

C.2 Preparation
Remove paint, rust, mill oils, and other surface contaminants at connection points.

C.3 Installation
Install in accordance to IEEE 142.

Install rod electrodes near location of electric service entrance unless otherwise shown on drawings. Install additional rod electrodes, if required, to achieve specified resistance to ground.

Install interconnecting wire 2 feet below finish grade.

Install grounding and bonding conductors concealed from view.

Install grounding well pipe with cover at rod locations as indicated on drawings. Install well pipe top flush with finished grade.

Ground electrical systems and equipment as required by code, utility, local ordinances, and to requirements herein.

Install separate code rated grounding conductors to special equipment and activity areas as required by code.

Bond all metallic piping systems and service equipment as required by NEC.

Permanently attach grounding conductors prior to energizing equipment.

Drive ground rods to a depth 4-inches below finished grade.

Grounding electrode conductor shall be continuous without splice from nearest building grounding electrode. Ground to service equipment. Install bonding jumper around water meter. Attach non-ferrous metal tag to warn against removal. Make connections to ground electrodes with approved molded exothermic weld process.

C.4 Equipment Ground

Bond metallic conduits, supports, cabinets, and other equipment so ground will be electrically continuous from service to outlet boxes.

Permanently ground entire light and power system in accordance to NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits.

Size grounding conductors in accordance to NEC.

Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment.

Install grounding conductor in nonmetallic and flexible conduit to complete equipment ground continuity.

Ground wire shall be bonded at equipment and at first junction box of conduit system on line side of flexible conduit to the system.

Install grounding conductors to permit shortest and most direct path from equipment to ground.

When grounding conductor runs through metallic conduit, bond to conduit at entrance and exit with a bolted clamp.

Ground neutral at service only.

Install a separate equipment grounding conductor in each conduit containing feeder conductors.

Install a green equipment grounding conductor in all conduits serving branch circuits.

Green ground bar in panels, where required to be similar to neutral bar, except tinted green and bonded to panel tub.

Connections shall be accessible for inspection and checking.

No insulation shall be installed over 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.

Ground metal lighting poles. Install a ground lug on inside wall of pole directly across from handhole.

C.5 Field Quality Control

Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

Inspect and test in accordance to NETA ATS, except Section 4.

Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13. Make final grounding system measurements two days after latest rainfall.

Perform ground resistance testing in accordance to IEEE 142. Contractor shall make ground resistance measurements. Measure in normally dry conditions, not less than 48 hours after rainfall.

Perform continuity testing in accordance to IEEE 142.

When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

86. Electrical Hangers and Supports, Section 26 05 29.

A Description

A.1 Summary

Section Includes:

a. Conduit supports
b. Formed steel channel
c. Spring steel clips
d. Sleeves
e. Mechanical sleeve seals
f. Firestopping relating to electrical work
g. Firestopping accessories
h. Equipment bases and supports

Related Sections

a. Applicable provisions of Section 26 00 00 shall govern all work under this Section.
b. Section 26 00 00 – Basic Electrical Requirements.

A.2 References

ASTM International (American Society for Testing and Materials):

a. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
b. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
c. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

FM Global (FM):

a. FM - Approval Guide, A Guide to Equipment, Materials and Services Approved By Factory Mutual Research For Property Conservation.

National Fire Protection Association (NFPA):

a. NFPA 70 - National Electrical Code.

Underwriters Laboratories, Inc. (UL):

a. UL 263 - Fire Tests of Building Construction and Materials.
b. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
c. UL 1479 - Fire Tests of Through-Penetration Firestops.
d. UL - Fire Resistance Directory.

Intertek Testing Services (Warnock Hersey Listed) (WH):

a. WH - Certification Listings.

A.3 Definitions
Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

A.4 System Description
Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

Surface Burning: ASTM E84, UL 723 with maximum flame spread / smoke developed rating of 25/450.

Firestop interruptions to fire rated assemblies, materials, and components.

A.5 Performance Requirements
Firestopping: Conform to applicable code for fire resistance ratings and surface burning characteristics.

Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

A.6 Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

Product Data:
a. Hangers and Supports: Submit manufacturers catalog data including load capacity.
b. Firestopping: Submit data on product characteristics, performance and limitation criteria.

Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

Design Data: Indicate load-carrying capacity of trapeze hangers and hangers and supports.

Manufacturer's Installation Instructions:
a. Hangers and Supports: Submit special procedures and assembly of components.
b. Firestopping: Submit preparation and installation instructions.

Manufacturer's Certificate: Certify products meet or exceed specified requirements.

Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

A.7 Quality Assurance
Perform work in accordance to state and municipality standards.

A.8 Qualifications
Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

Installer: Company specializing in performing work of this section with minimum five years documented experience.

A.9 Delivery, Storage and Handling
Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.

Accept materials on site in original factory packaging, labeled with manufacturer's identification.

Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

A.10 Environmental Requirements
Section 26 00 00 – Basic Electrical Requirements: Environmental conditions affecting products on site.

Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

Maintain this minimum temperature before, during, and for minimum three days after installation of firestopping materials.

Provide ventilation in areas to receive solvent cured materials.

B Materials
B.1 Conduit Supports
Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

B.2 Formed Steel Channel
Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

B.3 Spring Steel Clips
Product Description: Mounting hole and screw closure.

B.4 Sleeves
Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

Fire-stopping Insulation: Glass fiber type, non-combustible.

B.5 Mechanical Sleeve Seals
Manufacturers:

a. Link-Seal, Inc.
b. NMP Corporation
c. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements

Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

B.6 Firestopping
Manufacturers:

a. Dow Corning Corp.
b. Fire Trak Corp.
c. Hilti Corp.
d. International Protective Coating Corp.
e. 3M fire Protection Products
f. Specified Technology, Inc.
g. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements

Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

a. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
b. Foam Firestopping Compounds: Single component foam compound.
c. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
d. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
e. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
f. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
g. Firestop Pillows: Formed mineral fiber pillows.

Color: Dark gray.

B.7 Firestopping Accessories

Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

Dam Material: Permanent:
a. Mineral fiberboard.
b. Mineral fiber matting.

Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

General:
a. Furnish UL listed products or products tested by independent testing laboratory.
b. Select products with rating not less than rating of wall or floor being penetrated.

Non-Rated Surfaces:
a. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
b. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

C Construction

C.1 Examination

Verify existing conditions before starting work.

Verify openings are ready to receive sleeves.

Verify openings are ready to receive firestopping.

C.2 Preparation
Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

Remove incompatible materials affecting bond.

Install damming materials to arrest liquid material leakage.

Obtain permission from architect/engineer before using powder-actuated anchors.

Do not drill or cut structural members.

Obtain permission from architect/engineer before drilling or cutting structural members.

Install hangers, supports, and anchors only after structural work, where work is to be installed, has been completed. Correct inadequacies such as proper placement of inserts, anchors, and other building structural attachments.

Examine areas and conditions under which equipment and associated components are to be installed and notify architect, in writing, of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

C.3 Installation – Hangers and Supports
Anchors and Fasteners:

a. Concrete Structural Elements: Provide precast inserts, expansion anchors, and preset inserts.
b. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
c. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
d. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
e. Solid Masonry Walls: Provide expansion anchors and preset inserts.
f. Sheet Metal: Provide sheet metal screws.
g. Wood Elements: Provide wood screws.
h. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31 and to prevent the transfer of loading and stresses to connected equipment.
i. Installation methods shall be in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of hole be less than four bolt diameters. Minimum distance between the center of any expansion anchor and an edge of exterior corner of concrete shall be not less than 4-1/2 times the diameter of the hole in which it is installed.

Inserts:

a. Install inserts for placement in concrete forms.
b. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
c. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
d. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
e. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

Install conduit and raceway support and spacing in accordance to NEC.

Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

Install multiple conduit runs on common hangers.

Supports:

a. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
b. Install surface mounted cabinets and panelboards with minimum of four anchors.
c. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
d. Support vertical conduit at every floor.

C.4 Support of Conduit

Fasten conduit to structural parts of building in a manner acceptable to engineer.

Do not use perforated hanger iron.

Install concrete insert channel as required, with spacings as recommended by manufacturer. Install with anchor and caps, insert joiner clips and closer seals as required.

Support conduit as follows:

a. Single conduit runs vertical surfaces: galvanized, heavy duty, sheet steel straps; back straps to be provided for all exposed conduit and conduit on exterior walls.
b. Single conduit runs horizontal surfaces: galvanized, heavy duty, one hole malleable iron or 2 hole steel pipe straps.
c. Multiple conduit runs vertical surfaces: Horizontal or vertical rack channel with conduit straps as required.
d. Multiple conduit runs horizontal surfaces: Single or double rack channel trapeze, complete with conduit straps as required; all supported with threaded hanger rods.

e. Conduit runs through roof: conduit extending through roof shall pass through a ceiling box at roof lines. Provide 14 gauge minimum copper box complete with watertight soldered seams and flanged to serve as pitch pocket for each conduit. Conduit and pitch pocket shall be installed in advance of roofing work.

C.5 Installation – Firestopping

Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

Place intumescent coating in sufficient coats to achieve rating required.

Fire Rated Surface:

a. Seal opening at floor, wall, partition, ceiling, and roof as follows:
    i. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    ii. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
    iii. Pack void with backing material.
    iv. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
b. Where cable tray, bus, cable bus, conduit, wireway, trough, penetrates fire rated surface, install firestopping product in accordance to manufacturer's instructions.

Non-Rated Surfaces:

a. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening with material matching surface penetrated.
b. Interior partitions: Seal penetrations at computer rooms, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill space between surface and conduit.

C.6 Installation – Equipment Bases and Supports

Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.

Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

C.7 Installation – Sleeves

Exterior watertight entries: Seal with adjustable interlocking rubber links.

Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

Set sleeves in position in forms. Provide reinforcing around sleeves.

Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

Install stainless steel escutcheons at finished surfaces.

C.8 Field Quality Control
Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

Inspect installed firestopping for compliance with specifications and submitted schedule.

C.9 Cleaning
Provide under provisions of Section 26 00 00 – Basic Electrical Requirements.

Clean adjacent surfaces of firestopping materials.

C.10 Protection of Finished Work
Provide under provisions of Section 26 00 00 – Basic Electrical Requirements.

Protect adjacent surfaces from damage by material installation.

87. Raceway and Boxes, Section 26 05 33.

A Description
A.1 Summary
Section Includes:

a. Conduit
b. Tubing
c. Outlet Boxes
d. Pull Boxes
e. Junction Boxes
f. Handholes

Related Sections:

a. Applicable provisions of Section 26 00 00 – Basic Electrical Requirements shall govern all work under this section.
b. Section 26 00 00 – Basic Electrical Requirements.
c. Section 26 05 53 - Electrical Identification.

A.2 References

American National Standards Institute (ANSI):

a. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
b. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
c. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

National Electrical Manufacturers Association (NEMA):

a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
b. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
c. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
d. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
e. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
f. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
g. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

A.3 Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data: Submit for product data following:

a. Flexible metal conduit.
b. Liquid-tight flexible metal conduit.
c. Nonmetallic conduit.
d. Flexible nonmetallic conduit.
e. Nonmetallic tubing.
f. Raceway fittings.
g. Conduit bodies.
h. Surface raceway.
i. Wireway.
j. Pull and junction boxes.
k. Handholes.

Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

Include manufacturers' instructions for storage, handling, protection, examination, preparation, and installation of Product.

A.4 Closeout Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

Project Record Documents:
a. Record actual routing of conduits larger than 2 inch trade size (DN50).
b. Record actual locations and mounting heights of outlet, pull, and junction boxes.

A.5 Delivery, Storage and Handling
Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.

Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

Protect PVC conduit from sunlight.

A.6 Coordination
Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

B Materials
B.1 Design Requirements
Minimum Raceway Size: 3/4 inch unless otherwise specified.

B.2 Metal Conduit
Rigid Steel Conduit: ANSI C80.1.

Intermediate Metal Conduit (IMC): Rigid steel.

Fittings and Conduit Bodies: NEMA FB 1; Fittings for metal raceways shall be steel or malleable iron and shall be zinc galvanized, or cadmium plated. Do not use aluminum or die cast fittings.

B.3 PVC Coated Metal Conduit
Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.

Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit, PVC gasketed for mating surfaces.

B.4 Flexible Metal Conduit
Product Description: Interlocked steel construction.

Fittings: NEMA FB 1. Threaded, grounding type, insulated throat, two screw clamp type with locknuts, externally secured.

Minimum size 1/2 inch with the exception that 3/8 inch diameter may be used in lengths not to exceed 6 foot, to serve individual lighting fixtures installed in a suspended accessible ceiling system.

B.5 Liquid Tight Flexible Metal Conduit
Product Description: Interlocked steel construction with PVC sunlight resistant jacket.

Fittings: NEMA FB 1. Liquid tight, suitable for grounding, suitable for wet locations, tapered threaded hub, non-metallic materials.

B.6 Electrical Metallic Tubing (EMT)
Product Description: ANSI C80.3; galvanized tubing.

Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression, threaded, insulated throat, gland compression type, rain and concrete tight type.

B.7 Nonmetallic Conduit
Product Description: NEMA TC 2; Schedule 40 or 80 PVC, UL listed, and as required by NEC. Sunlight resistant.

Rated for 90 degrees C. cable.

Fittings and Conduit Bodies: NEMA TC 3, schedule 40 or 80, to match conduit.

Expansion fittings. PVC material, Carlon series E945 or equivalent.

Expansion straps. PVC material, Carlon series E978 or equivalent.

B.8 Expansion Fittings
Expansion fittings: Copper bonding jumper, Crouse-Hinds Type XJ.

Expansion/deflection fittings: Copper bonding jumper, Crouse-Hinds Type XD.

B.9 Outlet Boxes
Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

a. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
b. Concrete Ceiling Boxes: Concrete type.
c. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

Wall Plates for Finished Areas: As specified in Section 26 27 26.

Wall Plates for Unfinished Areas: Furnish gasketed cover.

B.10 Pull and Junction Boxes
Sheet Metal Boxes: NEMA OS 1, galvanized steel.

Hinged Enclosures: As specified in Section 26 27 16.

Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

a. Material: Galvanized cast iron.
b. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

Polymer concrete composite Handholes: Die-molded, polymer concrete composite hand holes:

a. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
b. Cover: polymer concrete composite, weatherproof cover with nonskid finish. Secure cover with stainless steel hex bolts.

C Construction
C.1 Examination
Verify outlet locations and routing and termination locations of raceway prior to rough-in.

C.2 Existing Work
Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

Remove concealed abandoned raceway to its source.

Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.

Clean and repair existing raceway and boxes to remain or to be reinstalled.

Cutting and patching

a. Provisions for openings, holes, and clearances through walls, floors, ceilings, and partitions shall be made in advance of construction.
b. Provide cutting and patching as necessary for installation of electrical systems, subject to approval of owner.

c. Contractor shall secure the approval of owner for all anticipated floor sleeves for installation of electrical conduits in existing buildings, prior to starting any such work.
d. Contractor shall locate embedded conduits before core drilling in existing floors. Ground detector systems will be acceptable.
e. Patching of holes and openings resulting from work of this branch shall be responsibility of this contractor. All painting of patched surfaces shall match existing paint color.

C.3 Restrictions

Split, crushed, or scarred conduit is not acceptable.

Welded conduit is not acceptable.

Do not route conduit over boiler, under boiler or in slabs below boiler, incinerator, or other high temperature equipment.

PVC conduit may not be used in the interior of building except at following locations.

a. PVC conduit may be used for grounding conductors.

C.4 System Description

Raceway and boxes located as indicated on drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

Underground more than 5 feet outside foundation wall: Provide schedule 40 nonmetallic conduit, unless otherwise noted on drawings.

Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit.

In or Under Slab on Grade: Provide schedule 40 nonmetallic conduit.

Outdoor Locations, Above Grade: Provide rigid steel conduit, unless otherwise noted. Provide cast metal outlet, pull, and junction boxes.

In Slab Above Grade: Feeder conduit shall not be installed in slab. Provide schedule 40 nonmetallic conduit with EMT elbow so any conduit above slab shall be metallic.

Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal junction and pull boxes. Provide flush mounting outlet box in finished areas.

Concealed Dry Locations: Provide rigid steel, intermediate metal conduit or electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

Exposed Dry Locations: Provide rigid steel, intermediate metal conduit or electrical metallic tubing, unless otherwise noted. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

Provide separate conduit system for each of the following systems:

a. 208 volt normal power wiring systems.
b. 480 volt normal power wiring systems.
c. 480 volt code required emergency power wiring systems.
d. Medium voltage wiring systems.
e. Low voltage lighting control systems.
f. Lightning Protection Systems
g. Fire alarm systems.
h. Area of rescue assistance call systems.
i. Closed circuit television (CCTV) systems.
j. Electronic Card Key Access System
k. Voice/data communications raceway systems.
l. Intercom, paging or sound system.

C.5 Installation

Install work in accordance to state and municipality standards.

All conduits containing service entrance conductors shall be rigid metal conduits.

Ground and bond raceway and boxes in accordance to Section 26 05 26.

Fasten raceway and box supports to structure and finishes in accordance to Section 26 05 29.

Identify raceway and boxes in accordance to Section 26 05 53.

Arrange raceway and boxes to maintain headroom and present neat appearance.

C.6 Installation – Raceway

Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

Arrange raceway supports to prevent misalignment during wiring installation.

Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

Secure conduits in place with malleable corrosion-proof alloy straps or hangers. Conduit straps used in corrosive areas shall be PVC coated.

Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.

Do not attach raceway to ceiling support wires or other piping systems.

Construct wireway supports from steel channel specified in Section 26 05 29.

Route exposed raceway parallel and perpendicular to walls.

Route raceway installed above accessible ceilings parallel and perpendicular to walls.

Route conduit under slab from point-to-point.

Conduits routed within concrete construction such as poured walls, floor slabs, topping slabs, shall comply with following requirements.

a. Conduits shall be parallel to each other, spaced on center to center distance of at least three times conduit trade diameter, and provided with a minimum of 2 inches of concrete.
b. Contractor shall note that precast planks below topping slabs may camber. Topping slab thickness will be less at high point of camber.
c. Conduits larger than 1-1/4 inch inside diameter shall not be installed in floor slabs. Conduits over 3/4 inch ID shall not be installed in topping slabs.
d. Conduits embedded in a structural frame slab shall comply with applicable provisions of American Concrete Institute (ACI), Standard 318. Refer to structural drawings for locations of structural frames.
e. Conduits used for feeders shall not be embedded in concrete floor slabs or concrete topping slabs.
f. Conduits in poured concrete construction shall not cross other conduits or other piping.
g. Unless specifically indicated on electrical drawings, conduits installed in poured concrete construction shall be approved by Structural engineer prior to conduit installation.
h. Contractor will be required to submit drawings showing conduit sizes and routings to Structural engineer for their review. Approval may not be given prior to bidding. Contractors who base their bid on assumption that conduits will be allowed in concrete construction do so at their own risk. No changes will be made to contract if, during construction, Structural engineer prohibits installation of conduit in concrete construction.
i. In areas constructed of precast concrete conduits may be run in cores of planks.

Maintain clearance between raceway and piping for maintenance purposes.

Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

Where conduits must cross or follow the same path as water, steam or other fluid piping, run electrical conduits above such piping wherever possible.

Cut conduit square using saw or pipe cutter; de-burr cut ends.

Bring conduit to shoulder of fittings; fasten securely.

Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

Install conduit hubs to fasten conduit to cast boxes in damp and wet locations.

Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size.

Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

Provide a watertight conduit system where installed in wet locations such as underground, or where embedded in concrete.

Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

Install suitable pull string or cord in each empty raceway except sleeves and nipples.

Install suitable caps to protect installed conduit against entrance of dirt and moisture.

Close ends and unused openings in wireway.

Conduit runs that extend through areas of different temperature or atmospheric conditions or that are partly indoors and partly outdoors shall be sealed, drained, and installed in a manner that will prevent drainage of condensed or entrapped moisture into cabinets, motors, or equipment enclosures.

Conduit connections at motors, transformers, and other equipment that vibrates.

a. Flexible metal conduit between 18 inches and 36 inches long for conduit connections at equipment that vibrates.
b. Liquid-tight flexible metal conduit where flexible connections are required and where conduit will be exposed to moisture, dirt, fumes, oil, corrosive atmosphere, etc. Provide with connectors to assure a liquid-tight, permanently grounded connection. Locate so it is least subject to physical abuse. Corrosive areas are identified on floor plan.
c. Use double locknuts and insulated bushings with threads fully engaged.

Direct buried underground conduit.

a. Exterior underground direct buried conduits shall be buried at a depth of not less than 30 inches below grade.
b. Provide conduits or ducts terminating below grade with means to prevent entry of dirt or moisture.
c. Underground conduits shall slope 1/8 inch per foot for proper drainage. Conduits shall drain toward manholes and junction boxes, not the electrical equipment.

C.7 Installation – Boxes

Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

Install stamped steel bridges to fasten flush mounting outlet box between studs.

Install flush mounting box without damaging wall insulation or reducing its effectiveness.

Install adjustable steel channel fasteners for hung ceiling outlet box.

Do not fasten boxes to ceiling support wires or other piping systems.

Support boxes independently of conduit.

Install gang box where more than one device is mounted together. Do not use sectional box.

Install gang box with plaster ring for single device outlets.

C.8 Interface with Other Products
Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance to Section 07 84 00.

Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in Division 07.

Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

C.9 Adjusting
Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

Adjust flush-mounting outlets to make front flush with finished wall material.

Install knockout closures in unused openings in boxes.

C.10 Cleaning
Clean interior of boxes to remove dust, debris, and other material.

Clean exposed surfaces and restore finish.

88. Electrical Identification, Section 26 05 53.

A Description
A.1 Summary
Section Includes:

a. Nameplates
b. Labels
c. Wire markers
d. Stencils
e. Underground Warning Tape

Related Sections:

a. Applicable provisions of Section 26 00 00 shall govern all work under this Section.
b. Section 26 00 00 – Basic Electrical Requirements.

A.2 Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data:

a. Submit manufacturer's catalog literature for each product required.
b. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

Samples:

a. Submit two tags, actual size.
b. Submit two labels, actual size.

A.3 Closeout Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Project Record Documents: Record actual locations of tagged devices; include tag numbers.

A.4 Quality Assurance

Perform work in accordance to state and municipality standards.

A.5 Qualifications

Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

Installer: Company specializing in performing work of this section with minimum five years documented experience.

A.6 Delivery, Storage and Handling

Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.

Accept identification products on site in original containers. Inspect for damage.

Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

A.7 Environmental Requirements
Section 26 00 00 – Basic Electrical Requirements: Environmental conditions affecting products on site.

Install nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

A.8 Extra Materials
Furnish under provisions of Section 26 00 00 – Basic Electrical Requirements.

Furnish two containers of spray-on adhesive.

B Materials
B.1 Nameplates
Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

Nameplates shall match identification shown on drawings.

Letter Size:

a. 3/8-inch high letters for identifying voltages, phase and number of wires.
b. 3/4-inch high letters for identifying equipment and loads.
c. Panelboards: Nameplates shall state: panel identification, voltage, phase and number of wires (example: LP1/BH1, 277/480V, 3PH, 4W).
d. Medium voltage cables: nameplates shall be self-extinguishing, resistant to oil, water and solvents. Nameplate shall be minimum size 1 inch X 4 inches. Nameplate shall note: switch feeder from, phase, where feeder starts and where feeder ends.

Minimum nameplate thickness: 1/8 inch.

B.2 Labels
Labels: Printed adhesive label tags, with 1/8-inch minimum height black letters on white background.

Wiring device labels: Printed adhesive label tags, with 1/8-inch minimum height black letters on clear background.

B.3 Wire and Cable Identification
Different conductor insulation colors and electrical tape colors shall be used to identify the different phases of conductors in a given circuit.

Code color requirements shall always be followed where applicable.

Following colors shall be as follows unless otherwise required by code:

a. 120/208 volt systems
    i. A-phase: solid black.
    ii. B-phase: solid red.
    iii. C-phase: solid blue.
    iv. Different colors shall be used to identify switched legs.
    v. Neutral conductor: solid white. Provide additional markings for neutral conductors in the same raceway as required by code.
b. 480/277 volt systems
    i. A-phase: Solid brown.
    ii. B-phase: solid orange.
    iii. C-phase: solid yellow.
    iv. Different colors shall be used to identify switched legs.
    v. Neutral conductor: solid gray. Provide additional markings for neutral conductors in the same raceway as required by code.
c. Ground Conductors: solid green. Provide additional markings for ground conductors in the same raceway as required by code.
d. For additions to existing buildings use existing color code system unless it violates code. If no wire color coding system is used; use color coding system listed above.

Wire and cable labels:

a. Feeder and branch circuits: label shall indicate panel and circuit number as actual installed.
b. Control Circuits: Control wire number as indicated on Drawings.

B.4 Conduit and Raceway Markers

Conduit color/stencil markings:

a. Medium Voltage System: Orange lettering on white background noting: HIGH VOLTAGE - ‘’actual line-to-line voltage’’.
b. 480 Volt System: Yellow color band.
c. 208 Volt System: Blue color band.
d. Fire Alarm System: Red colored band.
e. Telephone/Data System: Gray colored band.

B.5 Stencils

Stencils: With clean cut symbols and letters of following size:

a. Up to 2 inches Outside Diameter of Raceway: 1/2-inch high letters.
b. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.
c. 1/2-inch high letters minimum for identifying boxes and other equipment.

B.6 Underground Warning Tape

Description: 4-inch wide plastic tape, colored yellow with suitable warning legend describing type of buried electrical lines.

B.7 Panelboard Directories
Suitable for complete description of load served.

Directory shall be removable.

Typewritten card, describing loads served.

Provide steel frame holder on inside cover of door to hold directory.

Directory shall be covered with a clear plastic sheet.

C Construction
C.1 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 the 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.

Stenciling may only be used on equipment fronts in unfinished areas.

Receptacle labels shall identify panel and circuit number feeding receptacle.

Switch label shall indicate equipment controlled by switch. Do not label light switches unless otherwise noted on drawings.

C.2 Preparation
Degrease and clean surfaces to receive adhesive for identification materials.

C.3 Existing Work
Install identification on existing equipment to remain in accordance to this section.

Re-stencil existing equipment.

C.4 Installation
Install identifying devices after completion of painting.

Adhesive type labels not permitted except for phase and wire identification.

Hand written labels or embossed tape are not permitted.

Nameplate Installation:
a. Install nameplate parallel to equipment lines.
b. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners.

c. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners.
d. Secure nameplate to equipment front using screws or rivets.
e. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
f. Provide identification for the following:
    i. Conduit (provide stencil or color band).
    ii. Wires and cables (provide Color code and label).
    iii. Medium voltage cables.
    iv. Junction and pullboxes (provide color code and/or stencil).
    v. Wiring devices (provide label).
    vi. Equipment (provide nameplates).
    vii. Switchboards (provide nameplate to identify board and each load fed from switchboard)
    viii. Panelboards (provide nameplates and directory).
    ix. Transformers (provide nameplates).
    x. Motor starters (provide nameplates).
    xi. Fire alarm panel (provide nameplates).
    xii. Control panels (provide nameplates).
    xiii. Time contactor (provide nameplates).
    xiv. Contactor (provide nameplates).
    xv. Disconnect switch (provide nameplates).

Label Installation:
a. Install label parallel to equipment lines.
b. Install label for identification of individual control device stations.
c. Install labels for permanent adhesion.

Wire label Installation:
a. Install wire marker for each conductor at panelboard gutters and outlet or equipment connection. Label shall be within 1 foot of end of conductor.

Conduit Marker Installation:
a. Install conduit marker for each conduit longer than 6 feet.
b. Conduit Markers Spacing: 50 feet on center, minimum of one visible in every room.

Stencil Installation:
a. Junction boxes: identify system source and load served.
b. Junction boxes for electrical communications, signal and control systems: Identify system source and equipment serviced, stenciled in black on cover.
c. Junction boxes for Fire Alarm system: Junction box covers shall be painted red with “Fire Alarm” stenciled in black on cover.

Underground Warning Tape Installation:

a. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

Medium Voltage Cable identification:

a. Fasten label to cable with nylon tie-wraps.
b. Install cable labels on each conductor at each cable termination, each pullbox, each manhole, and at all other accessible locations.
c. During entire cable installation, phasing of conductors shall be maintained and identified.

89. Short Circuit/Coordination/Arc Flash Hazard Analysis Studies, Section 26 05 73.

A Description

A.1 Summary

Electrical contractor shall retain the services of an independent third party firm to perform a short circuit/coordination study/arc flash hazard analysis study as described herein.

Submit studies to design engineer along with submittal for distribution equipment Shop Drawings. prior to release of equipment for manufacture.

Studies shall include all portions of electrical distribution system from normal power source or sources, and emergency/standby sources, down to and including smallest circuit breaker in distribution system. Adequately cover normal system connections and those which result in maximum fault conditions in study.

Firm performing study should demonstrate capability and experience to provide assistance during start up as required.

Perform study and assessment based on SKM's Dapper, Captor and PowerTool software.

Related Sections:

a. Applicable provisions of Division 01 shall govern work under this section.

Complete system selective coordination shall be provided including time below 0.01 seconds for following specific systems:

a. Emergency Systems: Per NEC 700.27.
b. Legally Required Standby Systems: Per NEC 701.18.
c. Critical Operations Power Systems: Per NEC 708.54.
d. Essential Electrical Systems: Per NEC 517.26.
e. Elevator Circuits: Per NEC 620.62.

Study shall be stamped and signed by a Professional engineer (PE). PE shall put statement in summary of report that all systems that are required to be selectively coordinated per NEC are completely coordinated.

A.2 Data Collection for Study

Contractor shall provide required data for preparation of the studies. Engineer performing system studies shall furnish contractor with a listing of required data to be collected immediately after award of the contract.

Electrical contractor shall furnish engineer performing electrical system study wire sizes, insulation types, conduit types, and circuit length for use and verification in study.

A.3 References

Perform studies in strict accordance with latest revision of the following standards.

American National Standards Institute (ANSI)

a. ANSI C57.12.59 Guide for Dry-Type Transformer Through-Fault Current Duration.
b. ANSI/IEEE Std. 141 IEEE Recommended Practice for Electric Power Distribution for Industrial Plants.
c. ANSI/IEEE Std. 242 "Buff Book" IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
d. ANSI/IEEE Std. 602 IEEE Recommended Practice for Electric System in Health Care Facilities.

Insulated Cable Engineers Association (ICEA) Standards.

Occupational Safety and Health Administration (OSHA) Standards.

The National Fire Protection Association (NFPA)

a. NFPA 70 – National Electrical Code.
b. NFPA 70E Standard for Electrical Safety in the Workplace.

Institute of Electrical and Electronics Engineers, Inc. (IEEE)

a. IEEE 1584 Guide for Arc Flash Calculations.

A.4 Qualifications

Contractor shall have studies performed by qualified engineers of electrical distribution equipment manufacturer or by an owner-approved consultant. Contractor is responsible for providing pertinent information required by preparers of studies.

Firm should be currently involved in high- and low-voltage power system evaluation. Studies shall be performed, stamped and signed by a licensed professional engineer in State of Wisconsin. Submit credentials of individual(s) performing studies and background of firm to engineer for approval prior to start of the work. A minimum of five

years' experience in power system analysis is required for individual in charge of the project.

A.5 Submittals

Third party qualifications. Submit qualifications of individual(s) who will perform the work for approval prior to commencing studies. Use Power Tools software by SKM to perform calculations.

Provide studies in conjunction with equipment submittals to verify equipment ratings required.

Summarize results of power system study in a final report. Submit six bound copies of the final report. Provide two PDF copies of study, so that it can be more easily stored and shared. Also, provide two copies (on CD) of report in MS word, and two copies (on CD) of one-line diagram in PDF format.

Report shall include the following sections:

a. Overview.
b. Short Circuit Study.
    i. Purpose.
    ii. Explanation of Data.
    iii. Assumptions.
    iv. Analysis of Results.
    v. Recommendations.
c. Protective Device Coordination Study.
    i. Purpose.
    ii. Explanation of Data.
    iii. Assumptions.
    iv. Analysis of Results.
    v. Recommendations (Including NEC 700-27 Requirement).
    vi. CAPTOR Results.
    vii. Example Drawings.
    viii. Arc Flash Study.
    ix. Purpose.
    x. Explanation of Data.
    xi. Assumptions.
    xii. Analysis of Results.
    xiii. Recommendations.
    xiv. SKM Arc Flash Evaluation Report.
d. Prioritized Recommendations and Conclusions.
e. Appendices
    i. DAPPER One-line Diagrams.
    ii. AutoCAD One-line Diagrams.
    iii. SKM Protective Device Summaries.

iv. Reference Data.
v. Sample Work Permit Form.
vi. Copy of Warning Labels, including study date

f. Above sections shall include the following items in detail:
i. Obtain available fault current from local utility company.
ii. Short circuit studies shall evaluate available fault current at each bus (each change of impedance), including all three-phase motors.
iii. Coordination study recommendations for relay settings, breaker settings, and motor protection settings.
iv. Recommendations for improving coordination and/or load distribution, as well as ground fault requirements.
v. Arc flash values for two normal cases to define highest values (low short circuit and high short circuit).
vi. Arc flash values for two maintenance cases, which define arc flash values available at equipment that would be available if instantaneous trip of upstream circuit breaker is set at a minimum value. This is recommended if someone has to work on live equipment.
vii. IEEE standard one-line diagram with equipment evaluation and circuit breaker setting forms that clearly define system data and are easy to interpret.
viii. Recommendations to reduce arc flash incident energy in areas that require class 2 and higher PPE.
ix. Prioritized report summarizing recommendations from this study. This shall include observed NEC code violations and their corrective action.
x. Contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on 24-inch x 36-inch (minimum) extruded polystyrene backboard. Mount copies of this one-line diagram in each electrical room.

A.6 Quality Assurance
Reference standards listed in IEEE "Buff Book", latest edition.

Perform short circuit study in accordance to latest applicable IEEE and ANSI standards.

B (Vacant)

C Construction
C.1 Short Circuit and Coordination Study
Perform short circuit, coordination, and arc flash hazard studies using SKM Dapper, Captor and PowerTool for Windows software packages.

In short circuit study, provide calculation methods and assumptions, base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low

voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout system. Provide a ground fault current study for same system areas, including associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.

In protective device coordination study, provide time-current curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings. Study should clearly demonstrate compliance with NEC selective coordination requirements.

Curve sheets shall include power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

Include adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within transformer characteristics, including a point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection. Where primary device characteristic is not within transformer characteristics, provide a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.

Utilize equipment load data for study obtained by contractor from contract documents, including Contract Addendums issued prior to bid opening.

Include fault contribution of motors in the study. Notify engineer in writing of circuit protective devices not property rated for fault conditions.

Provide settings for motor starters for motors over 50 horsepower. Include in the study package and comment.

When an emergency generator is provided or existing, include phase and ground coordination of generator protective devices, to meet NEC Articles 700 and 701 requirements. Show generator decrement curve and damage curve along with operating characteristic of protective devices. Obtain information from generator manufacturer and include generator actual impedance value, time constants, and current boost data in study. Do not use typical values for generator.

Evaluate proper operation of ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss neutral grounds and ground fault current flows during a neutral to ground fault.

For motor control circuits, show MCC full-load current plus symmetrical and asymmetrical of largest motor starting current to ensure protective devices will not trip major or group operation.

C.2 Field Settings

Contractor shall perform field adjustments of protective devices as required to place equipment in final operating condition. Settings shall be in accordance to approved short circuit study, protective device coordination study, and arc flash hazard study.

Contractor shall carry out necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with approved short circuit and protective device coordination study at no additional cost to owner.

C.3 ARC Flash Hazard Study

Include arc flash hazard study as part of the short circuit and coordination study. Study shall include the following:

a. Determine and document possible utility and generator/emergency sources that are capable of being connected to each piece of electrical gear. Calculations shall be based on highest possible source connection.
b. Calculations to conform to NFPA 70E calculation standards. Calculate incident energy units in calories per square centimeter.
c. Provide recommended boundary zones and personal protective equipment (PPE) based on calculated incident energy and requirements of NFPA 70E for each piece of electrical gear.

Electrical contractor shall provide labeling as required by OSHA based upon results of arc flash hazard study. At a minimum, labeling shall contain the following information:

a. PPE level
b. Flash Hazard Boundaries
c. Flash Protection Boundary
d. Shock Hazard Boundaries such as Limited Approach Boundary, Restricted Approach Boundary, Prohibited Approach Boundary.
e. Study date

90. Electrical Utility Services, Section 26 07 00.

A Description
A.1 Summary
Section Includes:

a. Coordination and arrangements with Electric Utility Company for permanent electric service; payment of Electric Utility Company charges for service; service provisions; and utility metering equipment.

Related Sections:

a. Applicable provisions of Section 26 00 00 – Basic Electrical Requirements.

A.2 References
Local Electric Utility's Installation and Service Manual.

Local Electric Utility's Service Rules and Regulations.

A.3 Submittals
Section 26 00 00 – Basic Electrical Requirements: Requirements for submittals.

Submit shop drawings of service entrance equipment for approval by electric utility before submitting approved drawings to construction manager.

A.4 Quality Assurance
Perform work in accordance to electric utility company's written requirements.

Maintain one copy of each document on site.

B Materials
B.1 Electrical System Description
Electric Utility Company Contact: Mr. Dan Sande, 333 West Everett Street, A299; Milwaukee, WI 53203; Phone (414) 221-4578."

System Characteristics: 480Y/277 volts, three phase, four-wire, 60 Hertz.

Service Entrance: Underground.

B.2 Utility Meters
Furnished by contractor to meet electric utility requirements.

B.3 Utility Meter Base
Furnished by contractor to meet electric utility company requirements.

B.4 Metering Transformer Cabinet
Furnished by contractor to meet electric utility company requirements.

B.5 Transformer Pad
Provide transformer pad to meet requirements of electric utility company.

C Construction
C.1 Examination
Verify service equipment is ready to be connected and energized.

C.2 Existing Work
Remove exposed abandoned service entrance raceway and conductors.

Disconnect abandoned service equipment and remove.

Maintain access to existing service equipment, boxes, metering equipment, and other installations remaining active and requiring access. Modify installation or provide access panel.

Clean and repair existing service equipment to remain or to be reinstalled.

Outages:

a. Contractor shall be cognizant of importance of maintaining continuous operation of building electrical systems.
b. Demolition work shall therefore be conducted in such a manner that outages of any portion of this system will be of short duration, infrequent, at convenience of owner and scheduled in advance.
c. If critical circuits or feeders are affected by demolition, contractor shall provide necessary temporary wiring as required to maintain normal operation.
d. Work that is done to existing service and distribution will require careful coordination and planning to minimize outages. Contractor shall confer with owner, construction manager and electric utility.

C.3 Preparation
Confirmation of Electric Service. Consult with electric utility to verify service information specified herein and shown on drawings before submitting bid.

Contractor shall meet with electric utility prior to rough in to review and coordinate installation of electrical service and verify existing conditions and any special requirements.

Metering: Consult with electric utility regarding service entrance requirements and metering equipment.

Install metering equipment and empty conduit for metering conductors to meet standards and requirements of electric utility.

Electric Utility Charges. Include in base bid electric utility charges for electrical service.

Service installation shall comply with latest applicable standards of utility and National Electric Code. Refer to current electrical service installation manuals.

C.4 Installation

Underground Service Provisions:

a. Contractor shall provide:
    i. Install service entrance conduits to building service entrance equipment.
b. Utility company will connect service lateral conductors to service entrance conductors.

91. Dry Type Transformers, Section 26 22 00.

A Description

A.1 Summary

Section Includes:

a. Dry Type General Purpose Transformers.

Related Sections:

a. Applicable provisions of Section 26 00 00 shall govern all work under this section.
b. Section 26 00 00 – Basic Electrical Requirements.

A.2 References

National Electrical Manufacturers Association (NEMA):

a. NEMA ST 1 – Specialty Transformers (Except General Purpose Types).
b. NEMA ST 20 - Dry Type Transformers for General Applications.

International Electrical Testing Association (NETA):

a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

A.3 Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

A.4 Closeout Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

Project Record Documents: Record actual locations of transformers.

A.5 Qualifications
Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

A.6 Delivery, Storage and Handling
Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.

Store in clean, dry space. Maintain factory wrapping or provide additional canvas or 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. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

B Materials
B.1 General Purpose Transformers
Manufacturers:
a. Square D.
b. General Electric.
c. Cutler-Hammer.
d. Siemens.
e. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements.

Product Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on drawings.

Primary Voltage: Ratings indicated on drawings.

Secondary Voltage: Ratings indicated on drawings.

Insulation system and average winding temperature rise for rated kVA as follows:
a. 1-15 kVA: Class 185 with 115 degrees C rise.
b. 16-500 kVA: Class 220 with 115 degrees C rise.

Case temperature: Do not exceed 40 degrees C rise above ambient at warmest point at full load.

Winding Taps:
a. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.

b. Transformers 15 kVA and Larger: Two 2-1/2 percent taps above and two 2-1/2 percent taps below.

Sound Levels: Maximum sound levels are as follows: (levels shown shall be measured at 5 feet from the transformer)

a. 1-9 kVA: 40 dB.
b. 10-50 kVA: 45 dB.
c. 51-150 kVA: 50 dB.
d. 151-300 kVA: 55 dB.
e. 301-500 kVA: 60 dB.
f. 501-700 kVA: 62 dB.
g. 701-1000 kVA: 64 dB.

Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.

Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.

Mounting:

a. 1-15 kVA: Suitable for wall mounting.
b. 16-75 kVA: Suitable for wall, floor or trapeze mounting.
c. Larger than 75 kVA: Suitable for floor or trapeze mounting.

Coil Conductors: Continuous copper or aluminum windings with terminations brazed or welded.

Enclosure: NEMA ST 20, Type 3R ventilated. Furnish lifting eyes or brackets.

Isolate core and coil from enclosure using vibration-absorbing mounts. No metal-to-metal contact shall occur between coil/core and enclosure.

Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

Overload capacity shall be not less than 15 percent for continuous operation for 115 degrees C rise transformers.

Transformer shall have a UL “K” rating of 4 minimum.

Size as indicated on drawings.

B.2 Buck and Boost Transformers

Product Description: NEMA ST 1, factory-assembled, dry type two winding buck and boost transformers, ratings as indicated on Drawings.

Insulation system and average winding temperature rise for rated kVA as follows:
0.25-2 kVA: Class 185 with 80 degrees C rise.
3-7.5 kVA: Class 220 with 115 degrees C rise.

Primary Voltage: As indicated on drawings or as required.

Secondary Voltage: As indicated on drawings or as required.

Mounting: Wall.

Coil Conductors: Copper or aluminum continuous windings.

Lugs: Suitable for terminating conductors sized for full load ampacity of transformer unit when operating in buck-and-boost configuration shown.

Enclosure: NEMA ST 1, Type 1.

Isolate core and coil from enclosure using vibration-absorbing mounts.

Nameplate: Include transformer connection data.

B.3 Source Quality Control
Production test each unit according to NEMA ST20.

C Construction
C.1 Examination
Verify mounting supports are properly sized and located including concealed bracing in walls.

C.2 Existing Work
Disconnect and remove abandoned transformers.

Maintain access and adequate ventilation to existing transformers and other installations remaining active and requiring access and ventilation. Modify installation or provide access panel or ventilation grilles.

Clean and repair existing transformers to remain or to be reinstalled.

C.3 Installation
Set transformer plumb and level.

Use flexible conduit, in accordance to Section 26 05 33, 2-feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

Support transformers in accordance to Section 26 05 29.

a. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.
b. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.
c. Mount trapeze-mounted transformers as indicated on Drawings.

Provide seismic restraints.

Install grounding and bonding in accordance to Section 26 05 26.

C.4 Field Quality Control

Section 26 00 00 – Basic Electrical Requirements Field inspecting, testing, adjusting, and balancing.

Inspect and test in accordance to NETA ATS, except section 4.

Perform inspections and tests listed in NETA ATS, section 7.2.1.

C.5 Adjusting

Section 26 00 00 – Basic Electrical Requirements: Testing, adjusting, and balancing.

Measure primary and secondary voltages and make appropriate tap adjustments.

92. Panelboards, Section 26 24 16.

A Description

A.1 Summary

Section Includes:

a. Distribution Circuit Panelboards.
b. Branch Circuit Panelboards.

Related Sections:

a. Applicable provisions of Section 26 00 00 shall govern all work under this Section.
b. Section 26 00 00 – Basic Electrical Requirements.
c. Section 26 05 26 - Grounding and Bonding.
d. Section 26 05 53 - Electrical Identification.

A.2 References

Institute of Electrical and Electronic Engineers (IEEE):

a. IEEE C62.41 – Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits.

National Electrical Manufacturers Association (NEMA):

a. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
b. NEMA FU 1 – Low Voltage Cartridge Fuses.
c. NEMA ICS 2 – Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
d. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
e. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
f. NEMA PB 1 - Panelboards.
g. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

International Electrical Testing Association (NETA):

a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

National Fire Protection Association (NFPA):

a. NFPA 70 - National Electrical Code.

Underwriters Laboratories Inc. (UL):

a. UL 67 - Safety for Panelboards.
b. UL 1283 – Electromagnetic Interference Filters.
c. UL 1449 – Transient Voltage Surge Suppressors.

A.3 Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

Product Data: Submit catalog data showing specified features of standard products.

A.4 Closeout Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

A.5 Qualifications

Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

A.6 Maintenance Materials
Section 26 00 00 – Basic Electrical Requirements: Requirements for maintenance products.

Furnish two of each panelboard key. Panelboards shall be keyed alike.

A.7 Product Delivery, Storage and Handling
Do not store panelboards exposed to weather.
Protect panelboards against damage from work of other trades.

B Materials
B.1 Distribution Panelboards
Manufacturers:

a. Square D, I-line Series
b. GE Electrical
c. Siemens
d. Cutler-Hammer
e. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements.

Product Description: NEMA PB 1, circuit breaker type panelboard.

Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard. Bus shall be rated per panelboard schedule, 100 amp minimum.

Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 or 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, unless otherwise indicated on Drawings. Panels shall be fully rated, series rating is not acceptable.

Molded Case Circuit Breakers: NEMA AB 1, bolt-on type, circuit breakers with integral thermal and instantaneous magnetic trip handle for all poles. No handle ties of any sort will be approved. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

Circuit Breaker Accessories: Trip units as indicated on Drawings.

Enclosure: NEMA PB 1, Type 1 indoors, 3R outdoor and damp or wet locations, maximum 9.5 inches deep, 42 inches wide, cabinet box.

Provide cabinet front with hinged door with flush lock. Front cover shall 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.

Where indicated on drawings, provide TVSS unit mounted integral to panel. TVSS unit shall meet Section 26 35 53 requirements.

B.2 Branch Circuit Panelboards

Manufacturers:

a. Square D, NQOD or NF Series
b. GE Electrical
c. Siemens
d. Cutler-Hammer
e. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements.
f. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings, 100 amp minimum. Furnish copper ground bus in each panelboard.

Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt or 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, unless otherwise indicated on Drawings. Panels shall be fully rated, series rating is not acceptable.

Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles; no handle ties of any sort will be approved. Type HACR for air conditioning equipment circuits, HID rated for high intensity discharge lighting systems, or as indicated on Drawings.

Provide metal directory holders with clear plastic covers.

Do not use tandem circuit breakers.

Enclosure: NEMA PB 1, Type 1 indoors, Type 3R outdoors and damp or wet locations.

Cabinet Box: 6 inches deep, 20 inches wide.

Where indicated on drawings, provide TVSS units mounted integral to panel. TVSS unit shall meet Section 26 35 53 requirements.

Furnish wiring gutters in accordance to NEC.

Top or bottom feed as required.

Furnish with branch breaker positions and nominal current rating as indicated on Drawings.

Fronts:

a. Dead front safety type.
b. Door shall be built into panel front cover trim which allows access to breakers as well as to trim screw fasteners. Front cover construction with concealed trim screws and door hinges. Breaker access door shall have the following features:
    i. Concealed piano hinge.
    ii. Flush stainless steel cylinder tumbler type lock with spring loaded door pulls.
    iii. Locks keyed alike.
    iv. Code gauge steel with rust inhibiting primer and baked enamel finish.

Circuit Directory:

a. Suitable for complete descriptions.
b. Clear plastic cover.
c. Typewritten card, describing the loads served.
d. Provide steel frame holder on inside cover of door to hold directory. Directory shall be covered with a sheet of clear plastic.

C Construction

C.1 Existing Work

Maintain access to existing panelboard remaining active and requiring access. Modify installation or provide access panel.

Clean and repair existing panelboards to remain or to be reinstalled.

C.2 Installation

Install in accordance to manufacturer's written instruction, applicable requirements of NEC, NECA's "Standard of Installation," NEMA PB1.1, and in accordance to recognized industry practices.

Install flush or surface mounted as specified on drawings and schedules.

Support panel cabinets independently to structure with no weight bearing on conduits.

Install recessed panelboards to allow cover to be drawn tight against wall to provide neat appearance.

Install surface mounted panelboard interior so there is no gap between the panelboard back-box and cover.

Adjacent panel cabinets shall be of same size and mounted in horizontal alignment.

Attach nameplates. Nameplates for panels in public areas shall be attached to the inside face of the cover. Nameplates for panels in equipment rooms and other non-public areas shall be attached to the outside face of the cover.

Install panelboards plumb.

Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

Install filler plates for unused spaces in panelboards.

Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.

Install engraved plastic nameplates in accordance to Section 26 05 53.

Install spare conduits out of each recessed panelboard to accessible location: (2) 1 inch to above ceiling, (2) 1 inch to floor below. Identify each as SPARE.

Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance to NFPA 70.

C.3 Field Quality Control
Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

C.4 Inspection
Examine area to receive new panelboards to assure adequate clearance for installation.

Start work only after unsatisfactory conditions are corrected.

Inspect and test in accordance to NETA ATS, except Section 4.

Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

C.5 Adjusting
Adjust doors and operating mechanisms for free mechanical movement.

Tighten lugs and bus connections.

Clean interior of panelboard.

Sand, prime and paint scratched or marred surfaces to match original finish.

Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

93. Wiring Devices, Section 26 27 26.

A Description

A.1 Summary

Section Includes:

a. Wall Switches.
b. Receptacles.
c. Occupancy Sensors.
d. Device Plates.

Related Sections:

a. Applicable provisions of Section 26 00 00 – Basic Electrical Requirements shall govern all work under this Section.
b. Section 26 05 33 - Raceway and Boxes.

A.2 References

National Electrical Manufacturers Association (NEMA):

a. NEMA WD 1 - General Requirements for Wiring Devices.
b. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

A.3 Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

Submit a Lighting Plan marked by manufacturer showing location, orientation and model number of occupancy sensors and power packs. Provide interconnecting wire diagrams and catalog cut sheets of occupancy sensors and power packs.

A.4 Qualifications

Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' documented experience.

B Materials

B.1 General

Provide all wiring device types from a single manufacturer.

a. Use of a manufacturer's name and model or catalog number is for purpose of establishing standard of quality and general configuration desired.
b. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements.

Devices and Cover Plate Colors:

a. Coordinate device and cover plate color with final wall finish; verify color with architect before ordering.
b. Unless noted otherwise, receptacles and light switches controlling emergency or critical loads shall be red in color.

c. Adjustments in device or cover plate color shall be made in the field without additional compensation.

Unless otherwise indicated acceptable manufacturers are:

a. Hubbell
b. Leviton
c. Arrow-Hart, Inc.
d. Pass and Seymour
e. Substitutions: As approved by engineer.

B.2 Wall Switches

Switches:

a. Single Pole Switch: 20 amps, 120-277 volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1221.
b. Double Pole Switch: 20 amp, 120-277 volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1222.
c. Three-way Switch: 20 amps, 120-277 volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1223.
d. Four-way Switch: 20 amps, 120-277 volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1224.
e. Pilot Light (lighted) - Single Pole Switch: 20 amp, 120-277 volt, specification grade, clear polycarbonate toggle, back or side wired equal to Hubbell cat. No. HBL1221ILC.
f. Keyed Single Pole Switch: 20 amp, 120-277 volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1221L. Provide owner with a minimum of 4 keys for switches.
g. Momentary Contact Switch: 20 amps, 120-277 volt, specification grade, back or side wired, three positions, center off equal to Hubbell cat. No. HBL1557.

Explosion-Proof: 20 amp, 120-277 volt, UL listed. Provide Appleton Electric Company, EDS type or equal from Crouse Hinds.

B.3 Receptacles

General:

a. Receptacles shall be flush mounted.
b. Receptacles shall have full grounding straps and be suitable for side or side and back wiring.
c. Receptacles shall be Hubbell Nos. listed below or equal by approved manufacturer.
d. Unless noted otherwise, receptacles shall be 125 volt, 2 pole, 3 wire grounding.

Receptacles

a. Single Convenience Receptacle Where a single receptacle is wired to a dedicated 20 ampere: heavy duty, specification grade, 20 amp, 125 volt, NEMA 5-20R Hubbell cat. No. HBL5361.

b. General use Duplex Convenience Receptacle: heavy duty, specification grade, 15 amp, 125 volt, NEMA 5-15R Hubbell cat. No. HBL5262.
c. Duplex Receptacle Where a single duplex receptacle is wired to a dedicated 20 ampere: heavy duty, specification grade, 20 amp, 125 volt, NEMA 5-20R Hubbell cat. No. 5362.
d. Tamper-Resistant: Commercial specification grade, 20 amp Duplex, 125 volt, NEMA 5-20R, Hubbell cat. No. BR20TR.
e. Weather-Resistant: Corrosion resistant heavy duty, specification grade, 20 amp duplex, 125 volt, NEMA 5-20R, HBL53CM62 (Color – Yellow)
f. GFCI Receptacle: heavy duty, specification grade, self-testing, 20 amp, 125 volt, NEMA 5-20R, UL 2006 compliant, Hubbell cat. No. GFST20.
g. Tamper-Resistant GFCI: Heavy duty commercial grade, 20 amp duplex, 125 volt, NEMA 5-20R, UL 2006 compliant, Hubbell cat. No. GFTR20.
h. Weather-Resistant GFCI: Extra heavy duty grade, 20 amp duplex, 125 volt, NEMA 5-20R, UL 2006 compliant, Hubbell cat. No. GFR5362.
i. Hospital Use Receptacle: hospital grade, 20 amp, 125 volt, NEMA 5-20R Hubbell cat. No. HBL8300.
j. Transient voltage surge suppression Receptacle:
    i. Comply with UL 1449 and 498.
    ii. Damage alarm sounded when surge protection is not functioning. Provide means to turn off alarm.
    iii. LED indicator to indicate suppression circuit is fully functional.
    iv. 3 mov's will each be rated 150 volts, 240 joules and 20MM size.
    v. Specification grade, 20 amp, 125 volt, NEMA 5-20R.
    vi. Hubbell Cat. No. HBL5362.
k. Clock receptacle: receptacle, clock hanger, and stainless steel Hubbell Cat. No. HBL5235.
l. Isolated ground duplex receptacle: Orange, heavy duty, specification grade, 20 amp, 125 volt, NEMA 5-20R Hubbell cat. No. IG5362.

Weatherproof Cover Plate: Gasketed die cast metal plate with hinged and gasketed device covers. Cover shall allow cords to be plugged in and cover closed. Provide Intermatic WP1010MC for single duplex receptacles or WP1030MC for double (quad) duplex receptacles.

Receptacles fed from emergency circuits shall be red.

B.4 Special Purpose Outlets
Refer to “Special Outlet Schedule” on Drawings.

Electrical contractor shall be responsible for coordinating the following items with actual equipment being furnished for the project prior to installation of outlet.

a. Exact location and orientation of outlet. Field coordinate location of outlet with engineer/architect’s field representative, location shall not be scaled off electrical drawings.
b. Electrical characteristics of equipment, including voltage, phasing, ampacity, etc.

c. Physical characteristics of termination, e.g. receptacle configuration, cord-and-plug versus hard-wired equipment, etc.

B.5 Wall Plates

Provide wall plates for wiring devices, with ganging and cutouts as indicated and with metal screws for securing plates to devices, screw heads colored to match finish of plate.

Decorative Cover Plate for flush mounted devices: Thermoplastic, nylon, non-combustible, minimum 0.100-inch thick. Smooth, 302 stainless steel.

Device plates for surface mounted 4 inch square boxes; 1/2-inch raised galvanized steel covers.

Do not use jumbo cover Plates.

Weatherproof Cover Plate: Gasketed die cast metal plate with hinged and gasketed device covers. Cover shall allow cords to be plugged in and cover closed. Provide Intermatic WP1010MC for single duplex receptacles or WP1030MC for double (quad) duplex receptacles.

Plates for devices fed from emergency circuits shall be red.

B.6 Occupancy Sensors

General:

a. Unit shall have a convenient means to bypass sensor in case of failure so lighting can be operated manually.
b. Unit shall be provided with a readily viable test LED to indicate when sensor detects motion.
c. Sensor sensitivity and time delay shall be adjustable. Time delay shall be adjustable from 1 minute to 30 minutes at a minimum.
d. Unit shall be UL or ETL listed.
e. Unit shall be provided with a 3 year warranty.
f. Occupancy sensors may be infrared, ultrasonic or combination type. Chosen manufacturer shall provide optimum technology needed for each space where a sensor is shown.

Manufacturers:

a. Watt Stopper
b. Leviton
c. MyTech
d. Hubbell
e. Substitutions: As approved by engineer.

Passive Infrared Wall Switch:

a. Sensor shall use passive infrared detection method for detecting room occupancy. Unit shall fit in/on a standard single gang switch box and require only two wires and a grounded box for operation.
b. Rated capacity: 600 watts minimum at 120 volts, 60 Hz, 1000 watts minimum at 277 volts, 60 Hz for fluorescent lamps, larger size to accommodate load as shown on Drawings.
c. Switch shall have manual override for positive off.
d. Area of coverage shall be 250 square feet minimum, greater range to accommodate room size as shown on Drawings.
e. Model Watt Stopper: DI Series.

Ceiling-Mounted Dual Technology Occupancy Sensor:

a. Sensor shall employ both infrared and ultrasonic sensing methods to detect room occupancy. Unit shall fit in/on a standard octagon box.
b. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps.
c. Area of coverage shall be adjustable. Unit shall be provided with a dip switch to allow either detection technology to be independently configured.
d. Unit shall be provided with a dip switch to select one of five different sensing modes as dictated by environmental factors.
e. Model: Watt Stopper: DT-300.

C Construction

C.1 Examination

Verify outlet boxes are installed at proper height.

Verify wall openings are neatly cut and completely covered by wall plates.

Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

C.2 Preparation

Clean debris from outlet boxes.

C.3 Existing Work

Disconnect and remove abandoned wiring devices.

Modify installation to maintain access to existing wiring devices to remain active.

Clean and repair existing wiring devices to remain or to be reinstalled.

C.4 Installation

Switches controlling equipment operation of which is not evident from switch position shall include pilot light in conjunction with proper switch.

Each switch shall be complete with engraved plate to identify equipment being controlled. Provide black letters on clear background, 1/8-inch high, minimum.

Do not install devices until after wall finishes have been completely applied.

Any outlets installed prior to walls being finished and used for construction power shall be replaced at time of substantial completion.

Install devices and wall plates plumb and level.

Install switches with OFF position down.

Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

Do not share neutral conductor on load side of dimmers.

Install receptacles with grounding pole on top.

Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

Route continuous green equipment grounding conductor with branch circuit conductors serving isolated ground receptacles. Terminate equipment ground on isolated ground bus in panelboards.

Install emergency switches, which occur adjacent to normal light switches in separate boxes to maintain systems isolation in accordance to the NEC.

Install decorative plates on switch, receptacle, and blank outlets in finished areas.

Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller.

When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or otherwise make circuit connections via wire connectors and pigtails.

Provide a layer of electrical tape around perimeter sides of each wiring device so that terminations are insulated.

Where GFI protected receptacles are indicated on Drawings, each receptacle indicated shall be a GFI receptacle. Standard receptacles protected with an upstream GFI receptacle shall not be approved.

Multiple or Special Switch Stations:

a. Grouped local switches under common cover plate as scheduled or noted on the drawings. Provide pilot lights on all circuits remote from general area or exterior to building. Eight-gang plate maximum - where two plates are required, same shall be equal in size and located one above the other. Switch plates shall include an engraved, Bakelite nameplate to identify function of each switch. Nameplate shall be screwed in place.

Occupancy Sensors:

a. Install sensors within rooms in accordance to manufacturer's guidelines and recommendations.
b. Infrared sensors shall be placed where they will have a direct line of sight to occupied areas.
c. Ultrasonic sensors shall not be placed immediately adjacent to HVAC diffusers. High velocity air movement may result in nuisance tripping of sensor.

C.5 Interface with Other Products

Coordinate locations of outlet boxes provided under Section 26 05 33 – Raceway and Boxes to obtain mounting heights as indicated on Drawings.

C.6 Field Quality Control

Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

Inspect each wiring device for defects.

Operate each wall switch with circuit energized and verify proper operation.

Verify each receptacle device is energized.

Test each receptacle device for proper polarity.

Test each GFCI receptacle device for proper operation.

Occupancy Sensors:

a. Sensitivity Test: After sensor has been energized for at least 15 minutes, walk to middle of room (if conference room) or sit at normal desk position (if an office). Make no motion for 20 seconds. Move one arm up and down slowly. Test LED should blink.
b. Time Delay Test: Set time delay for 10 minutes. Walk into room to activate sensor, then leave room. Sensor must turn lights off at approximately 10 minutes.

If a device fails to properly operate, replace at no extra charge to owner.

C.7 Adjusting
Devices and face plates on a common wall with common mounting heights shall be level and square to each other. Adjustments required after installation shall be made without additional compensation.

Mark conductors with panel and circuit number serving device, at device.

Mark panel and circuit number serving device on backside of device plate with a permanent marking system that does not show through front of plate.

C.8 Cleaning
Clean exposed surfaces to remove splatters and restore finish.

94. Fuses, Section 26 28 13.

A Description
A.1 Summary
Section Includes:
a. Fuses.

Related Sections:
a. Applicable provisions of Section 26 00 00 shall govern all work under this section.
b. Section 26 00 00 – Basic Electrical Requirements.

A.2 References
National Electrical Manufacturers Association (NEMA):
a. NEMA FU 1 - Low Voltage Cartridge Fuses.

A.3 Design Requirements
Select fuses to provide appropriate levels of short circuit and over-current protection for the following components: wire, cable, bus structures, and other equipment. Design system to maintain component damage within acceptable levels during faults.

Select fuses to coordinate with time current characteristics of other over-current protective elements, including other fuses, circuit breakers, and protective relays. Design system to maintain operation of device closest to fault operates.

A.4 Fuse Performance Requirements
Main Service Switches Larger than 600 amperes: Class L, Bussmann low-peak or equivalent, bolt in, 200,000 ampere interrupting rating.

Main Service Switches: Class RK1. Bussmann low-peak or equivalent, one-end rejection, 0-600 amp, 200,000 ampere interrupting rating.

Load Feeder Switches Larger than 600 amperes: Class L. Bussmann low-peak or equivalent, bolt in, 200,000 ampere interrupting rating.

Load Feeder Switches: Class RK1. Bussmann low-peak or equivalent, one-end rejection, 0-600 amp, 200,000 ampere interrupting rating.

Motor Load Feeder Switches: Class RK1. Bussmann low-peak or equivalent, one-end rejection, 0-600 amp, 200,000 ampere interrupting rating.

Motor and general purpose Branch Circuits: Class RK1. Bussmann low-peak, LPS-R or equivalent, dual element, time delay with short circuit protection, 200,000 ampere interrupting rating.

Lighting Branch Circuits: Class G.

Control Power Transformer Circuits: Class CC.

A.5 Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

A.6 Closeout Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

Project Record Documents: Record actual sizes, ratings, and locations of fuses.

A.7 Qualifications
Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

A.8 Maintenance Materials
Section 26 00 00 – Basic Electrical Requirements: Spare parts and maintenance products.

Furnish two fuse pullers.

A.9 Extra Materials
Section 26 00 00 – Basic Electrical Requirements: Requirements for extra materials.

Furnish three spare fuses of each Class, size, and rating installed.

B Materials
B.1 Fuses
Manufacturers:
a. Bussmann
b. Ferraz-Shawmut
c. Littlefuse
d. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements.

Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on drawings.

Voltage: Rating suitable for circuit phase-to-phase voltage.

B.2 Spare Fuse Cabinet
Product Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.

Doors: Hinged, with hasp for owner's padlock.

Finish: Gray enamel.

C Construction
C.1 Existing Work
Remove fuses from abandoned circuits.

Maintain access to existing fuses and other installations remaining active and requiring access. Modify installation or provide access panel.

C.2 Installation
Install fuse with label oriented so manufacturer, type, and size are easily read.

Install spare fuse cabinet as indicated on drawings.

95. Enclosed Switches, Section 26 28 19.

A Description
A.1 Summary
Section Includes:
a. Fusible and Non-fusible switches.

Related Sections:
a. Applicable provisions of Section 26 00 00 shall govern all work under this Section.
b. Section 26 00 00 – Basic Electrical Requirements.
c. Section 26 28 13 - Fuses.

A.2 References
National Electrical Manufacturers Association (NEMA):
a. NEMA FU 1 - Low Voltage Cartridge Fuses.
b. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

International Electrical Testing Association (NETA):
a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

A.3 Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data: Submit switch ratings and enclosure dimensions.

A.4 Closeout Submittals
Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

A.5 Qualifications
Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B Materials
B.1 Fusible Switch Assemblies
Manufacturers:
a. Square D
b. Cutler Hammer/Westinghouse
c. Siemens
d. General Electric
e. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements.

Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Provide means to temporarily override interlock and allow door to be opened with switch on.

Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
a. Interior Dry Locations: Type 1
b. Exterior Locations: Type 3R
c. Wet Locations: Type 4

Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

Furnish switches with entirely copper current carrying parts.

Provide ANSI/UL Class RK1, dual element, time delay, 600 volt fuses in disconnect switches, sized as shown on drawings.

Quick make and break operator mechanism.

Handle attached to box, not cover.

Handle position indication, ON in up position and OFF in down position.

Padlock provisions for up to three padlocks in OFF position.

UL listed lugs for type and size of wire specified.

Spring reinforced fuse clips for Type R fuses.

Provisions for insulated or grounded neutral.

B.2 Nonfusible Switch Assemblies

Manufacturers:

a. Square D
b. Cutler Hammer/Westinghouse
c. Siemens
d. General Electric
e. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements.

Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position enclosed load interrupter knife switch. Provide means to temporarily override interlock and allow door to be opened with switch on.

Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.

a. Interior Dry Locations: Type 1.
b. Exterior Locations: Type 3R.
c. Wet Locations: Type 4.

Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

Furnish switches with entirely copper current carrying parts.

Quick make and break operator mechanism.

Handle attached to box, not cover.

Handle position indication, ON in up position and OFF in down position.

Padlock provisions for up to three padlocks in OFF position.

UL listed lugs for type and size of wire specified.

Provisions for insulated or grounded neutral.

B.3 Switch Ratings
Switch Rating: Horsepower rated for AC or DC as indicated on drawings.

Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R fuses (30-600 ampere switches employing appropriate fuse rejection schemes).

C Construction
C.1 Existing Work
Disconnect and remove abandoned enclosed switches.

Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.

Clean and repair existing enclosed switches to remain or to be reinstalled.

C.2 Installation
Provide disconnect switches for loads as required by code. Review HVAC and Plumbing specifications to determine what equipment is furnished with disconnect switches.

Install all disconnect switches whether furnished under this contract.

Electrical contractor shall determine need for a disconnect switch requirements for each specific load.

Contractor shall include in their bid all disconnect switches required whether indicated on the drawings or not.

Install enclosed switches plumb.

Height: 5 feet to operating handle.

Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

Install engraved plastic nameplates in accordance to Section 26 05 53.

Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

Install in accordance to manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance to recognized industry practices.

Locate disconnect switches as shown on drawings or as required by NEC.

Install on equipment support where feasible, or anchor firmly to wall or structural surface.

Provide control circuit interlock as required by NEC.

C.3 Adjustment
Adjust covers and operating mechanism for free mechanical movement.

Verify overcurrent protection to provide proper operation and compliance with NEC.

Tighten wire and cable connections.

Clean interior of enclosure.

Touch up scratched or marred surfaces to match original finish.

C.4 Field Quality Control
Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

Inspect and test in accordance to NETA ATS, except Section 4.

Perform inspections and tests listed in NETA ATS, Section 7.5.

96. Transient Voltage Surge Suppressor, Section 26 35 53.

A Description
A.1 Summary
Section Includes:

a. Transient Voltage Surge Suppressors.

Related Sections:

a. Applicable provisions of Section 26 00 00 shall govern all work under this Section.
b. Section 26 00 00 – Basic Electrical Requirements.

c. Section 26 24 13 - Switchboards: Transient voltage surge suppressors integrated in switchboards.
d. Section 26 24 16 - Panelboards: Transient voltage surge suppressors integrated in panelboards.

A.2 References

Institute of Electrical and Electronics Engineers (IEEE):

a. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.
b. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
c. IEEE C62.45 - Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

National Electrical Manufacturers Association (NEMA):

a. NEMA LS 1 - Low Voltage Surge Protection Devices.

National Fire Protection Association (NFPA):

a. NFPA 70 - National Electrical Code, Article 285.
b. NFPA 780 - Standard for the Installation of Lightning Protection Systems.

Underwriters Laboratories Inc. (UL):

a. UL 1283 - Electromagnetic Interference Filters.
b. UL 1449 - Transient Voltage Surge Suppressors.

A.3 Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for submittals.

Product Data: Submit capacity, dimensions, weights, details, and wiring configuration.

UL 1449 Second Edition Listing, Standard for Safety, Transient Voltage Surge Suppressors, documentation.

UL 1283 Listing, Electromagnetic Interference Filters, documentation.

IEEE C62.41, Category C3 (20kV-1.2/50, 10kA-8/20μs waveform) clamping voltage test results.

A.4 Closeout Submittals

Section 26 00 00 – Basic Electrical Requirements: Procedures for closeout submittals.

Project Record Documents: Record actual locations of transient voltage surge suppressors.

Operation and Maintenance Data: Submit manufacturer's descriptive literature, installation instructions, and maintenance and repair data.

A.5 Quality Assurance
List individual units under UL 1449 and UL 1283.

Perform work in accordance to state and local codes.

A.6 Qualifications
Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years experience.

A.7 Delivery, Storage and Handling
Deliver, store and protect products under provisions of Section 26 00 00 – Basic Electrical Requirements.

Accept equipment on site in factory packaging. Inspect for damage.

Protect equipment from damage by providing temporary covers until construction is complete in adjacent space.

A.8 Warranty
Section 26 00 00 – Basic Electrical Requirements: Requirements for warranties.

B Materials
B.1 Transient Voltage Surge Suppressor (TVSS)
Manufacturers:

a. Cutler-Hammer, Inc.
b. General Electric Company
c. Square D Company
d. Siemens Energy & Automation, Inc., TPS Series
e. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements.

Manufacturer of SPD shall be the same as manufacturer of distribution equipment in which devices are installed and shipped.

TVSS shall be installed by and shipped from electrical distribution equipment manufacturer's factory.

Product Description: Surge protective devices for protection of AC electrical circuits.

Each module shall be fused with a surge rated fuse.

Unit Operating Voltage: As indicated on drawings.

TVSS shall have a UL approved means of disconnect.

TVSS shall have copper bus for surge current path. Small round wiring connections shall not be used in the path for surge current diversion.

Construction:

a. Balanced Suppression Platform: Equally distribute surge current to Metal Oxide Varistor (MOV) components to ensure equal stressing and maximum performance. Furnish surge suppression platform with equal impedance paths to each matched MOV.
b. Internal Connections: Hardwired with connections using low impedance conductors and compression fittings.
c. Safety and Diagnostic Monitoring: Equipped with standard overcurrent protection:
    i. Continuous monitoring of fusing system.
    ii. Monitor individual MOV's (including neutral to ground). Capable of identifying open circuit failures not monitored by conventional fusing systems.
    iii. Monitor for overheating in each mode due to thermal runaway.
    iv. Furnish green and red solid state indicator light on each phase. Absence of green light and presence of red light indicates which phases have been damaged. Fault detection activates flashing trouble light and alarm. An alarm on/off switch shall be provided to silence the alarm. Units not capable of detecting open circuit damage, thermal conditions, and over current will not be accepted.
d. Labeling: Permanently affix UL 1449 suppression voltage ratings to unit.

Rating:

a. Electrical Noise Filter: Furnish each unit with high performance EMI/RFI noise rejection filter. Electric line noise attenuation no less than 50 dB at 100 kHz using MIL-STD-220A insertion loss test method.

Accessories:

a. Local audible alarm.
b. Form C dry contacts one normally open (NO) and one normally closed (NC) for remote status monitoring.

SPD shall be listed in accordance to UL 1449 Second Edition and UL 1283, Electromagnetic Interference Filters.

SPD shall be listed in accordance to UL 1449 Second Edition to include Section 37.3 highest Short Circuit Current Rating (SCCR) of 200 kA.

SPD shall be tested with the Category C3 high exposure waveform (20kV-1.2/50µs, 10kA-8/20µs) per ANSI/IEEE C62.41 - 1991.

Pulse life test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41 Category C3 transients without failure or degradation of clamping voltage by more than 10 percent:

Service Entrance Type TVSS shall have a minimum surge current rating of 160 kA per phase.

Distribution type TVSS shall have a minimum surge current rating of 120 kA per phase.

Protection Modes: For Wye configured system, furnish device with directly connected suppression elements between line to line (L-L), line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For Delta configured system, furnish device with suppression elements between line to line (L-L) and line to ground (L-G).

Do not exceed the following for maximum UL 1449 suppression voltage ratings:

Modes	208Y/120	480Y/277
WYE - L-N; L-G; N-G	400 V	800 V

TVSS shall be designed to withstand a maximum continuous operating voltage of not less than 115 percent of nominal RMS voltage.

B.2 Source Quality Control and Tests
Section 26 00 00 – Basic Electrical Requirements: Field inspecting, testing, adjusting, and balancing.

Test units to specified surge ratings to ensure devices will achieve required life expectancy and reliability. Testing to full ratings also verifies internal construction quality of suppressors. Provide withstand testing for each mode and each phase basis.

Perform actual Let-Through voltage test data in form of oscillograph results for ANSI/IEEE C62.41 Catalog C3 (20 kV, 10 kA), Catalog C1 (6 kV, 3 kA), and Catalog. B3 (6 kv, 500 A at 100 kHz) tested in accordance to ANSI/IEEE C62.45.

Perform spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying device noise attenuation exceeds 50 dB at 100 kHz.

Perform test verifying suppressors can survive published surge current rating for each mode and each phase basis. Test wave based on ANSI/IEEE C62.41, 8x20 microsecond current wave.

C Construction
C.1 Examination
Verify existing conditions before starting work.

Verify mounting area is ready for equipment.

Verify circuit rough-ins are at correct location.

C.2 Installation
Mount internally to new power distribution equipment or on existing distribution equipment as noted on drawings.

Install in accordance to IEEE 1100.

Install using direct bus bar connection.

Install indicator lights and trouble alarms in face of power distribution equipment.

97. Luminaires, Lighting Controls, and Emergency Lighting Inverter, Section 26 51 00.

A Description
This special provision describes luminaires, lighting controls, and emergency lighting inverter for the electrical system as specified on the electrical drawings, inferable there from and specified herein.

B Materials
B.1 Luminaires
B.1.1 Manufacturers
As specified in the light fixture schedule.

Alternates as listed in light fixture schedule.

B.1.2 Exit Signs
Exit signage shall have 6-inch high lettering meeting code and standard requirements of federal, state, and local jurisdictions where project is located.

Provide directional arrows as indicated and required by authorities having jurisdiction.

Provide mounting accessories as required to back, end, pendant, or top mount in accordance to project requirements.

Exit signage shall be modular design, facilitating replacement of individual parts.

B.1.3 Submittals
Include outline drawings, catalog cut sheets, lamp and ballast data, support points, weights, accessory information, and performance data for each luminaire type.

For all luminaries with paint color or finish options, include single color original of manufacturers color or finish choices for engineer's review.

B.1.4 Product Data
Submit dimensions, ratings, and performance data.

B.1.5 Record Drawings
For installations utilizing remotely mounted low voltage transformers, Electrical contractor shall provide set of record drawings indicating location of installed transformers to facilitate future maintenance.

B.2 Lighting Controls
B.2.1 Manufacturers
Approved Manufacturers as listed:

a. Nex-Light NX-4800 or equal
b. Lutron
c. Lighting Control and Design
d. Approved equal

B.2.2 General
Provide system software and hardware that is warranted by a single manufacturer.

System has a lifetime operation while operating continually at any temperature in an ambient temperature range of -10° C (14°F) to 50° C (122°F) and 85 percent non-condensing relative humidity.

Contractor is responsible to coordinate all of the work in this section with all of the trades covered in other sections of the specifications to provide a complete and operable system.

B.2.3 Requirements and Compliance
The system shall comply with applicable provisions of the current National Fire Protection Association standard, local building codes and meet all the requirements of the local authorities having jurisdiction.

Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

The system shall be listed or registered with Underwriters Laboratories Inc. UL508 or UL924.

All applicable components/assemblies shall meet emission standards as suitable by the FCC as specified in Part 15, Subpart J for Class A installations.

B.2.4 Switch Function
The system shall provide the following switch functions:

a. Individual: ON/OFF control of individual relays from single or multiple locations.
b. Group: ON/OFF control of groups of relays and dimming units from single or multiple locations.

c. Pattern: ON/OFF control of lighting patterns allowing for the programming of any number of the available relays and dimming addresses so that each of the addresses making up the pattern will switch to either the ON or OFF state in response to the pattern signal and from single or multiple locations. All the relays/dimmers at the affected addresses may be programmed to switch ON, all the relays/dimmer addresses may be programmed to switch OFF, or some addresses can be programmed to switch ON and others OFF in response to the pattern signal and from single or multiple locations.

B.2.5 Time Delay Functions

A switch assigned an ON Timer shall respond to actuation by turning ON the affected relay/dimmer address for a user-selectable period of time. At the expiration of the time, the address shall be automatically switched OFF unless the switch button has been pushed OFF before the expiration of the timer. ON Timers shall have a user-selectable duration of 30 seconds 1, 5, 60, or 120 minutes.

A switch assigned an OFF Delay shall switch the affected relay/dimmer address OFF only after the expiration of a user entered delay time. OFF Delays shall have a user selectable duration of 30 seconds, 1, or 5 minutes.

Individual, Dimmer, and Group switches shall be capable of being assigned either an ON Timer or OFF Delay function.

Timer functions shall be switch specific. Different switches controlling the same Relay/Dimmer address can have different timer functions, or one of the switches can be assigned no timer function. The relay shall respond according to the timer function assigned the switch that is activated.

Group or Pattern switches shall be capable of processing up to eight timer functions assigned at the individual address level.

B.2.6 System Programmability

The system shall be completely programmable. Any switch (i.e. manual, contact input or wireless) can be programmed to control any Relay or Dimmer. In addition any Relay or Dimmer may be programmed into multiple Groups or Patterns. The same control function can be implemented from any number of locations by duplicating the switch parameters at multiple locations. Changes to Individual, Pattern or Group control of the Relays and Dimmers shall be accomplished without rewiring or other hardware changes.

Definition of Group and Pattern switch functions shall be accomplished via a programming station or device that places the system in programming mode allowing definition of each Group and Pattern function and setting system switches to the proper states.

B.2.7 System Communications/Data Transmission
Recommended Bus wire: 16 ga., plenum rated, unshielded, stranded Bell Wire- (twisted or, shielded does not affect performance) Belden 6200UE (unshielded, plenum rated.) Belden 5200UE (unshielded, non-plenum rated)

All system components shall be connected by a 2-wire low voltage non-polarized signal bus over which all system data, commands and power are transmitted. LONworks not permitted to connect directly to the 2-Wire bus.

Each component shall be terminated to the bus by means of connecting one of the bus conductors to one of the device terminals and the other bus wire to the other device terminal. Cross wiring of the bus conductors to system components shall have no deleterious effects on system operation. The bus will not require a specific layout. An optional high reliability closed loop structure shall be possible.

The 2-wire communication bus shall properly function if laid out in Daisy Chain, Star-tap, T-tap or a combination of these methods. (The closed loop method shall require 2-wire polarity to be observed.)

B.2.8 Interface with Non-System Control Devices
The system shall provide a dry contact interface with non-system devices such as third-party Time Clocks, Building Automation Systems (optional method), third-party Occupancy Sensors and Photocells or any other devices that provide dry contact closure outputs.

Contact Input Modules designed for this purpose shall have independently addressable channels permitting each input channel to control any or all relay/dimmer/motor control addresses in the system. Each input shall be configurable for either Individual, Dimmer (ON/OFF), Group, or Pattern switch functions.

B.2.9 Status Indication, Diagnostics, and Overrides
The 20Amp HID rated relay shall have manual override capability. This switch can be used to manually set the relay to either the ON or OFF state regardless of whether the system electronics are operational.

The 20Amp HID rated relay shall feature English Language indication of the relay’s "ON or OFF" state incorporated on the body of the component.

Each switch button shall feature two status LEDs; Red indicating the programmed switch function is active and Green indicating non-active.

System shall be capable of tracking true status even if the relay is manually overridden.

B.2.10 Expandability/Flexibility
New components shall be added to the system by attaching them to the 2-wire low voltage non-polarized signal bus and setting their parameters with the hand-held IR programming unit in-advance or on-site.

System components shall be suitable for either panel or field mounting.

System shall be totally programmable and multiplexed.

Additional capacity shall be provided by adding Transmission Units, Amplifiers, and or other needed components (If required by project size).

The Transmission Unit (System Processor and Amplifier Units) shall provide visual indication of shorted communication signal bus. System is self-correcting once short is removed.

B.2.11 Staggered Start
System shall feature sequential response of relays to ON commands thus protecting against demand spikes cause by simultaneous switching of large numbers of relays.

B.2.12 BMS Integration and Networking Solutions
(BACnet, MODbus, LONworks, ARCnet 156, TCP/IP, N2)
The direct digital interface to building automation systems shall use DDC protocols such as BACnet, Metasys (N2) and ModBus that accept on/off commands and report status of all relays in all panels in real time. A single hardware platform shall be capable of interface to BACnet, MODbus, LONworks N2, and RS485 protocols.

Interface shall "self populate" each individual relay, Pattern function and group function to the BAS. Groups and pattern programming shall be the responsibility of the lighting control system.

All BAS system programming required shall be the responsibility of the electrical contractor.

B.2.13 Component Description
B.2.13.1 Transmission Unit (CPU)
Provides central microprocessor to manage communications between intelligent switches, relays and all other system components with the following capabilities:

a. 256 Relay and Dimmer Addresses
b. 16 Dedicated Legacy Dimming Addresses
c. 127 Group Addresses
d. 72 Pattern Addresses
e. Uses a NexLight 2-wire non-polarized signal bus to communicate with and provide power to the system components.
f. Provides up to 5,000 feet signal bus distance using #16 AWG wire.
g. Additional distance can be achieved by the use of amplifiers.

h. Each Group and Pattern Function shall be able to control up to 256 Relay, Motor Control and/or Dimming addresses (max, 64 of the 256 addresses used for dimming).
i. Any Relay or Dimming Address can be contained in any number of Group or Pattern commands while simultaneously allowing for individual control of same.
j. Provides non-volatile EEPROM memory protection of system configurations and programs. No battery backup required.
k. Allows two modes of operation:
l. Normal Mode
m. Programming Mode
n. Allows for Group and Pattern addressing and programming through use of handheld programmer and the individual switches with no other hardware required.
o. Provides sequencing of relay activation.
p. Provides ON-Timer and OFF-Delay timing to all Individual, Group, Pattern and Dimmer switch functions.
q. ON-Timer and OFF-Delay timer functions shall be allowed in each Group and Pattern function.

B.2.13.2 Astronomical Time Clock

Shall include the following features:

a. 30-channel (schedule) Time Clock in panel.
b. Shall include the ability to program 30 individual time schedules.
c. Programs may be scheduled with a combination of Astro and Normal times.
d. Programs may be placed in "stand-by" from a NexLight switch.
e. Provide 7 year "schedule" back-up without the use of external power.
f. May be removed from the system without affecting system operation.
g. Auto time synchronizing for multiple Time Clocks on the same system.

B.2.13.3 Relays

Shall include the following features:

a. 20 Amp, HID SPST Relay (120, 208, 240, 277 and 347V).
    i. Provides ON/OFF control of lighting and other electrical loads.
    ii. Provides mechanical override switch on the relay.
    iii. Electrical Life: 150,000 cycles or more at full load @ 20cpm.
    iv. Ratings (UL):

        General Use: 20A, 300 Vac
        Tungsten: 2400W, 120 Vac
        HID: 20A, 300 Vac
        Ballast: 20A, 300 Vac
        Motor: 1/2 HP at 110-125 Vac; 1 1/2 HP at 220-277 Vac

b. May be directly controlled by 24 Vdc.
c. Single pole relay rated at 14,000Amps SCCR.
d. Must be mechanically held to either the ON or OFF state.
e. Provides highly visible English Language indication of the ON/OFF state of the relay.

B.2.14 Submittals

The contractor is responsible for assuring that the conduit size and wire quantity, size and type are suitable for the system supplied. Review the proper installation of each type of device with the equipment supplier.

Provide complete system documentation at acceptance including:

a. As-built drawings of project.
b. Equipment supplier submittals.
c. System operation manual.

B.2.15 Specification Conformance Document

Indicate whether the submitted equipment:

a. Meets specification exactly as stated.
b. Meets specification via an alternate means and indicate the specific methodology used.

B.2.16 Shop Drawings

Shop drawings shall include:

a. Bill of Materials/Relay Panel Build Schedules: In a bill-of-materials format, an itemized list of all materials supplied to meet the specification/project requirements.
b. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.
c. Schematic of system.
d. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

B.3 Emergency Lighting Inverter

B.3.1 Manufacturers

Approved Manufacturers as listed:

a. Lithonia: EAC-FT-10000 – 277/277-OB12 or equal.
b. Dual-Lite
c. Cooper
d. Approved equal

B.3.2 General

Furnish and install a Inverter System to provide a reliable source of emergency power, designed to operate during periods of utility line deficiencies without any interruption in power supplied to the connected load. The transfer from utility power to battery power shall utilize a true no break system to prevent sensitive loads from “winking out”. The system shall provide a pulse width modulated sine wave output to the connected load, and be capable of powering any combination of electronic, power factor corrected, fluorescent, incandescent or HID lighting. Other connected loads shall include but not be limited to: building management systems, motors, security systems and other critical

voltage or frequency-sensitive electronic loads. The system shall operate from 0-100% loading, and be rated to deliver full KVA rated output at unity power factor for a minimum of 90 minutes. A boost-tap transformer shall provide regulated output during brownouts within -10% of incoming line voltage without transferring to battery. Upon return to normal AC utility line power, the system shall recharge the batteries without any interruption of power supplied to the load.

B.3.3 Codes and Standards

The Inverter System shall be listed to or comply with these standards:

a. UL 924 Standard for Emergency Lighting and Power Equipment, when equipped with Type S batteries and a 90-minute run time.
b. UL 1778 Standard for Uninterruptible Power Supply Equipment, when equipped with Type G or Type N batteries, or run times other than 90-minutes.
c. ANSI C62.41: ANSI C62.45 (Cat. A and B)
d. FCC class A
e. National Electrical Code (NFPA 70)
f. The Life Safety Code (NFPA 101)
g. OSHA

B.3.4 Operation

System operation shall be fully automatic and include a linear transformer with boost tap and surge protection. In emergency mode, true “no break” Pulse Width Modulated (PWM) power shall be supplied to the load at all times.

The charging system will maintain the batteries at full capacity at all times.

Three on-board microprocessors will continuously monitor charger settings and the system’s overall readiness. Diagnostic circuitry shall include a multi-rate, software controlled charger, continuous monitoring of 265 operating parameters, and programmable system testing capabilities.

Thirty individual alarms and nine system logs shall be provided. All alarms and logs shall be automatically recorded and readily displayed via the User Interface Display (UID). The system shall also include one RS232 serial port for remote two-way communications

Automatic overload and short circuit protection in normal and emergency mode shall consist of 150% momentary surge capability, 120% overload for 5 minutes, and 110% overload for 10 minutes. Protection shall also include a low battery voltage disconnect, AC input circuit breaker, a DC input breaker, and an AC output fuse. A digitally generated sinusoidal output waveform (PWM) with less than 5% total harmonic distortion at rated linear load shall be provided to the connected load. A boost tap transfer protection circuit shall maintain the desired output voltage during low voltage “brownout” conditions without continuously switching to batteries, thereby preserving battery capacity.

B.3.5 Input Voltage
Available input voltage selection shall include 120, 208, 240, 277, and 347 volts, +10% to -15%, single phase, with a frequency of 60Hz. The AIC rating shall be 42,000 RMS symmetrical amperes.

B.3.6 Output Voltage
Available output voltage shall include 120, 208, 277, 120/240, 120/277, 120/208, 347, 120/347 volts, +/- 5%, single phase sine wave, with a frequency of 60Hz + 0.05Hz.

The output frequency, when on utility power, shall be as supplied by the utility.

B.3.7 System Diagnostics
The user interface display (UID) shall include an array of 5 LED's, a 2-line, 40-character LCD display, and a keypad for system input. The UID shall be menu-driven and display individual system parameters using a numbered code (Hot Key). The LED array shall indicate, by color code, the following status modes: AC output presence (green), system ready (green), battery charging (red), inverter "ON" (amber), and alarm functions (red).

To ensure only authorized personnel have system access, a multi-level password shall be required to change all functions and operating parameters.

B.3.8 Batteries
To comply with UL Listing to Standard 924 (Emergency Lighting), Type S batteries shall be designed to provide a minimum 1.5 hours rated output voltage to the connected load in emergency mode without dropping below 87.5% of nominal battery voltage.

The batteries shall be enclosed in an enclosure that permits easy maintenance without requiring removal.

The following battery types shall be available:

a. Sealed Lead Calcium, VRLA, (Type S): Maintenance Free Construction Standard battery supplied, unless otherwise specified. Requires no addition of water over its useful life. The case and cover shall be constructed of polypropylene, contain a UL recognized low-pressure safety release vent, and be non-gassing in normal use. Life expectancy is 10-yeasr at 77°F (25°C) ambient temperature.
b. Sealed Lead Calcium VRLA (Type G): Maintenance Free Construction An optional long-life battery. Requires no addition of water over its useful. Life expectancy is 20-years at 77°F (25°C) ambient temperature.
c. Wet Cell Nickel Cadmium (Type N): Wet cell construction An optional long-life battery. Requires maintenance inspection and the addition of water to the cells when required. Pocket plate construction with a translucent case. Life expectancy is 25-years at 77°F (25°C) ambient temperature.

B.3.9 Warranty
The system shall be guaranteed, under normal and proper use, against defects in workmanship and materials for a period of two years from the date of shipment. Batteries

supplied as part of the systems shall be covered under a separate pro-rata warranty as described below.

a. Sealed Lead Calcium VRLA, 10-year life expectancy (Type S) – one-year full replacement manufacturer's warranty plus an additional nine years pro-rata.
b. Sealed Lead Calcium, 20-year life expectancy (Type G) – One year full replacement manufacturer's warranty plus an additional 14 years pro-rata.
c. Wet Cell Nickel Cadmium, 25-year life expectancy (Type N) – One year full replacement manufacturer's warranty plus an additional 14 years pro-rata.

B.3.10 System Options

The following optional factory-installed equipment shall be available (see catalog for additional details):

a. Internal Maintenance Bypass Switch (IBS): A factory-installed, internally-mounted three-position "make before break" switch. Compatible with all input/output combinations and any combination or quantity of output circuit breakers. Allows connecting the utility power supply to the load without placing the inverter in emergency mode.

B.3.11 Mechanical

The system shall be contained in a code gauge, steel NEMA 3R enclosure, finished in a scratch resistant, powder coat finish, with a key lock, conduit knockouts at the top and sides, and front opening doors with air filters. Enclosures shall be designed to allow stacking to minimize the overall system's footprint. The system shall include a plenum to expel heated air from inside the unit. All components shall be front accessible and incorporate a modular design and a quick disconnect means to facilitate servicing.

B.3.12 Submittals

The contractor is responsible for assuring that the conduit size and wire quantity, size and type are suitable for the system supplied. Review the proper installation of each type of device with the equipment supplier.

Provide complete system documentation at acceptance including:

a. As-built drawings of project.
b. Equipment supplier submittals.
c. System operation manual.

Specification Conformance Document: Indicate whether the submitted equipment:

a. Meets specification exactly as stated.
b. Meets specification via an alternate means and indicate the specific methodology used.

B.3.13 Shop Drawings

Bill of Materials: In a bill-of-materials format, an itemized list of all materials supplied to meet the specification/project requirements.

Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

C Construction
C.1 Luminaires
C.1.1 Installation
Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

Install recessed luminaires to permit removal from below.

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.

Surface and wall recessed fixtures shall be connected directly to junction box or solid conduit.

Ceiling recessed fixtures shall be connected to flexible metal conduit, originating at solidly supported J-Box.

Flexible metal conduit shall be minimum 3/8 inch diameter. Conduit length shall allow movement of fixture for maintenance purposes.

Minimum wire size shall be #12 AWG.

Electrical contractor shall check structural drawings, architectural reflected ceiling plans, and general construction drawings to verify construction and type of surface on or in which lighting fixtures are installed.

C.1.2 Field Quality Control
Operate each luminaire after installation and connection.

Inspect for proper connection and operation.

C.1.3 Adjusting
Aim and adjust luminaires as indicated on drawings and adjust as directed by designated owner personnel.

C.1.4 Cleaning
Remove dirt and debris from enclosures.

Clean photometric control surfaces as recommended by manufacturer.

Clean finishes and touch up damage.

C.1.5 Protection of Finished Work
Relamp luminaires having failed or noticeable dim lamps at substantial completion.

C.2 Lighting Controls
C.2.1 Installation
Install equipment in accordance to manufacturer's installation instructions.

Provide complete installation of system in accordance to contract documents.

Define each dimmer's/relay's load type, assign each load to a zone, and set control functions.

Provide equipment at locations and in quantities indicated on drawings. Provide any additional equipment required to provide control intent.

C.2.2 System Start Up and Programming
Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:

Qualifications for factory-certified field service engineer:

a. Minimum experience of 2 years training in the electrical/electronic field.
b. Certified by the equipment manufacturer on the system installed.

Make a visit upon completion of installation of control system:

a. Verify connection of power feeds and load circuits. Verify connection and location of controls. Verify proper connection of panel links (low voltage/data) and address panel. Verify system operation control-by-control, circuit-by-circuit. Verify proper operation of supplied interfacing equipment to other devices. Obtain sign-off on system functions. Users to be trained on system operation.

C.2.3 System Commissioning
Electrical contractor is required to provide a minimum of three weeks advance notice for request and scheduling of factory commissioning (start-up).

Electrical contractor is required to provide one electrician to remain on site and to be available at all times during the system commissioning process and through to its completion.

Electrical contractor is to provide manufacturer with detailed contact information for the individual primarily responsible for oversight of the system installation and system commissioning process. This individual's responsibility is to include receipt of, and dissemination of all Lighting Control System installation instructions and other related documentation pertinent to the installation and commissioning of the system.

Installed systems shall only be commissioned by an authorized technician.

C.3 Emergency Lighting Inverter
C.3.1 Wiring
Input and output conductors shall be enclosed in separate conduits. All load side wiring shall be sized as required for voltage drop conditions to assure proper operation of connected loads.

C.3.2 System Operation
The system shall allow connection of both “normally on” and "normally off” (optional) loads. Connected loads shall receive utility power during normal operation, and ‘no break” system inverter power during utility interruptions.

C.3.3 Connected Loads
In emergency mode, the inverter system shall supply true digitally-generated AC sinusoidal output. Refer to plans for type and location of loads served by the system.

C.3.4 Factory Start-up
A factory trained service representative shall be dispatched to perform the initial system start-up.

Factory Start-Up shall be supplied as an inverter system standard at no additional cost. The Factory Start-Up process shall verify correct installation and operation of the inverter system. Trained, factory-authorized technicians shall administer an on-site, point-by-point check of the system to include:

a. Internal electrical connections
b. AC input and Battery connections
c. System operating voltages
d. System operating parameters
e. Initial system “power-up
f. Battery discharge test
g. Correction of existing deficiencies
h. Final testing, calibration and recording
i. Training of available operating personnel

98. Technology Cabling System, Section 27 15 00.

A Description
A.1 Summary
Technology Cabling System

Related Sections

a. Section 27 05 00 – Basic Technology Requirements
b. All other Division 27 and 28 Sections
c. Division 26 – Electrical

A.2 System Description
Technology contractor shall furnish, install and test all cabling and equipment necessary for a complete and functioning technology cabling system as specified and indicated on drawings. Conduit, raceway and outlet boxes for the "Information Outlets" shall be provided as indicated in these project documents.

Furnish and install all faceplates, patch panels, equipment racks, equipment trays and all other items necessary for a complete technology cabling system.

The cabling system shall be comply to EIA/TIA 568B, TSB-67, and ISO/TEC IS 11801.

A.3 Project/Site Conditions
Examine areas and conditions under which all items are to be installed, and notify the project manager in writing of conditions detrimental to proper completion of the work. Do not proceed with that portion of the work affected until unsatisfactory conditions have been corrected in a manner acceptable to installer.

A.4 Sequencing/Coordination
Technology contractor shall coordinate the receipt of all materials being provided by the owner to ensure installation proceeds without delays.

Technology contractor shall attend meetings as required by the project manager.

Technology contractor shall review and be familiar with the construction project.

A.5 Pathways for Technology Systems
Electrical contractor shall provide the required conduit stubs and back boxes for all devices shown on the technology plans. In general requirements are a 4" square box with a single gang ring. Provide a 1" min conduit with a threaded bushing to the cable tray.

A.6 Submittals
Initial Project Documentation: Technology contractor shall submit the following to the architect for approval prior to ordering equipment:

a. Catalog sheets with complete technical data for all materials being furnished. Exact part/model numbers being provided shall be highlighted.
b. Complete itemized "Bill of Material"

Complete listing of Charges as follows:

a. Hourly rate for maintenance.
b. Hourly rate for installation.

Documentation as follows:

a. The technology contractor is an authorized dealer/distributor of the products and systems to be provided.
b. The technicians assigned to this project have been properly trained on the installation/maintenance of the model/type of cabling system to be provided.

Final Project Documentation: Technology contractor shall submit the following project documentation to the project manager for approval prior to “Final Acceptance”.

a. As built drawings shall include by not limited to the following:
    i. Any changes made to the system during installation.
    ii. Location of all information outlets including jack number identification generated by AutoCAD text.
b. As built drawings shall be as follows:
    i. ONE copy in “Full Size” plans
    ii. ONE copies on AutoCAD Disk(s)
    iii. ONE copy in REDUCED size - 11" X 17" (Included in the Technical Manual)
c. Technology contractor shall furnish ONE complete technical manual containing the following:
    i. Layout of EACH rack in EACH equipment room as installed. (Visio Professional or equivalent)
    ii. Layout of EACH device in EACH equipment rack as installed. (Visio Professional or equivalent)
    iii. REDUCED size - 11" X 17" as built drawing with the correct location of all information outlets and jack number generated by AutoCAD text.

A.7 Qualifications

Technology contractor shall have at least 4 years’ experience in the installation of similar systems. The Technology contractor shall provide documentation upon request to certify that all assigned staff has attended training courses corresponding to the type of cabling and equipment specified herein.

Technology contractor shall currently be licensed to install low voltage electronic cabling systems in the State if applicable.

Technology contractor shall currently meet all manufacturers’ requirements for the provision and installation of all equipment specified herein.

Technology contractor shall utilize and have operators trained in the utilization of the Category 6 and fiber optic test equipment.

a. Category 6 test equipment (FLUKE DSP 4000/DSP4100)
    i. Set “Pass/Fail” range for distance at 90 Meters (296 Feet)
    ii. Test for applicable Category 6 standards.
    iii. “Summary Page(s)” showing jack number, cable footage, and “Pass/Fail” MUST be included in the “Technical Manual”... One copy of the “Summary Page(s) is REQUIRED PRIOR to “Substantial Completion”.
b. Fiber Optic Cable test equipment (Lucent Technologies or equivalent)
    i. Test for loss - 850 nm and 1300 nm for multimode, 1310 nm and 1550 nm for single mode
    ii. Provide length for each fiber optic cable.

iii. Results must be in electronic generated text stated in DB and generated from electronic readout of the fiber test equipment.

A.8 Maintenance Service

Provide maintenance of cabling system for TWENTY years from date of final acceptance.

Warranty: Warrant the cabling system against malfunction due to component failure or improper installation for a period of TWENTY years from the date of final acceptance. When notified of a malfunction, proceed to immediately correct the situation by replacement or repair without cost to the owner. Extend manufacturer's warranties when necessary to achieve the full duration. Clearly indicate provisions in the warranty manual.

Response Time: Within the warranty period, Technology contractor will effect replacement of defective parts within one business day after receiving notification of a problem.

Warranty inspection: Prior to expiration of the FIRST year service period, arrange to make an inspection of the cabling system. Make adjustments and correct defects that exist to bring the system up to as-new specifications.

B Materials

Main Technology Closet to Platform Signs: Furnish and install a 6 Strand Multimode Fiber – 50 Micron between each Platform Sign and the Main Technology Closet (Room 116A). Terminate all strands at both ends. In Room 116A terminate fiber on a rack mounted patch panels in LC connectors. Fiber Cable and Connectors shall be Commscope or Approved Equal.

In Signs terminate fiber in a protective enclosure with LC connectors on a connector panel mounted in the enclosure.

Copper Riser Cable: Furnish five 4 Pair Category THREE riser cable from the Main Technology Closet to the 5 signs located on Platform 2. These cables will be used for future wireless by the owner.

Provide 6 category 6 data cables from Main Technology Closet (Room 116A) to the Computer Room on 3rd Floor. Coordinate termination with DOT IT Staff.

Cabling

Horizontal Copper Cabling:

a. All horizontal Station Cables shall terminate on modular Patch Panels in the Telecommunications Rooms (TR) as specified on the drawings.
b. All horizontal Voice Station Cables shall terminate on modular Category 6 Patch Panels in the Telecommunications Rooms (TR) as specified on the drawings.
c. All cables, termination components and support hardware shall be furnished, tested, installed and wired by the contractor.

d. All cables and termination hardware shall exceed the TIA/EIA Category 6 technical standards and be installed in accordance to the referenced TIA/EIA/BICSI documents. Minimally complaint Category 6 cabling is unacceptable for this project. Category 6 cabling used for this project must provide an average margin of +2dB or more above the stated values in the Category 6 Cable Permanent Link Test table listed later in this specification.
e. 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.
f. 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.

DSL Cable:

a. Furnish and install Category 3 cable compliant TIA/EIA technical standards in accordance to the referenced TIA/EIA/BICSI documents. The cable shall be 4 pair and terminate on 8P8C connector in the Signs on Platform 2.
b. 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.

Multi-mode Optical Fibers in each cable shall meet the following specifications:

a. Fiber Type - 50 Micron Multi-mode; doped silica core surrounded by concentric glass cladding.
b. Index Profile Graded Index
c. Transmission Windows 850-nm and 1300-nm
d. Core Diameter (nom) 50.0-mm (microns) ± 3
e. Cladding Diameter 125-mm ± 2
f. Core-clad Concentricity £ 3-mm
g. Cladding Non-circularity £ 2.0%
h. Fiber Coating Diameter - 250-mm ± 15 (primary coating). All coatings shall be mechanically strippable without damaging the optical fiber.
i. Attenuation (max. @ 23±5 °C; Backbone) - @ 850-nm 3.0-dB/km, @ 1300-nm 1.0-dB/km
j. Changes to multi-mode fiber performance at extreme operational temperatures (-40 to +70 C) shall not exceed 0.2 dB/km at 1300 nm (per FOTP-3 procedures).
k. Bandwidth (min.) @ 850-nm 2000-MHz*km, @ 1300-nm 500-MHz*km
l. No multi-mode optical fiber shall show a point discontinuity greater than 0.2 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that fiber by the owner.
m. Belden, Commscope, BerkTek or equivalent.

Equipment Racks:

a. Main Technology Closet Rack Assembly, Vertical Organizer
b. Chatsworth 30161-703...BLACK or Equal
c. (Quantity TWO at EACH Technology Closet)
d. Cable Runway
e. Chatsworth 11275-012 or Equal.
f. Provide 1½" stringers and all required connectors, hardware, bolts, etc.
g. Secure rack to ALL four walls of the Technology Closet.

Patch Panels:

a. RJ-45 Category 6 Patch Panels: Furnish and install patch panels for termination of Horizontal Technology Cabling shall be Commscope Uniprise or equal.
b. Cable Management Brackets: Furnish and install cable management terminations on patch panels. Provide ONE per each patch panel.

B.1 General

All products bid shall be the most current and up-to-date versions available, unless otherwise specified.

Technology contractor shall provide written notification to the project manager, prior to submitting the bid, of any discrepancies in model or part numbers specified.

Technology contractor shall provide written notification to the project manager, prior to bidding, of the announced discontinuation or replacement of any items specified herein.

Technology contractor shall provide all necessary supplies, mounting hardware and accessories required to install the materials specified herein.

B.2 Product Substitutions

As stated in the project documents.

C Construction

C.1 General

Install all equipment and components in accordance to manufacturer's written instructions, in compliance with NEC, and with recognized industry practices, to ensure that all items comply with specifications and serve intended purposes.

All cabling and equipment shall be installed in accordance to good engineering practices as established by the EIA and the NEC. Cabling shall meet all applicable local, state, and federal building codes and laws.

Record serial numbers of all items provided that are serialized. Refer to PART 1 - SUBMITTALS for presentation format. To be completed prior to Final Acceptance.

All items must be complete as specified prior to Final Acceptance. It will be the responsibility of the technology contractor to ensure cabling meets all specifications and standards defined herein.

It will be the responsibility of the technology contractor to ensure that any cable run from the TC to the “Information Outlet” jack does NOT exceed 90 Meters (296 Feet).

C.2 Installation

Cabling - General:

a. Furnish and install cabling runs between the MTC/TC to each information outlet specified on drawings. A dedicated cabling run shall be utilized for each faceplate jack.
b. Conduit sleeves shall be provided by the technology contractor except as noted on the plans...fire stopping as follows:
c. The exterior perimeter of the NEW sleeve shall be fire stopped at installation with a paintable material.
d. The interior ALL sleeves shall be fire stopped prior to substantial completion.
e. Furnish and install face plates and faceplate jacks in outlet boxes for all information outlets specified on drawings.
f. All jacks shall be terminated in accordance to cable pinout detail 568A
g. Furnish and install grommets and/or bushings in conduit ends PRIOR TO INSTALLING the cabling to prevent damage to insulation or conductors.
h. Use Velcro ® Bands to secure cable bundles in the MTC and TC locations. Cable Ties NOT used on this project to the cable bundles Cable ties MUST be able to be turned freely around the bundle of cable
i. Tighten connectors and terminals, including screws and bolts, in accordance to equipment manufacturer's published torque tightening values for equipment connectors.
j. Allow sufficient slack in cable to prevent premature deterioration of cable system components and to assist in the maintenance and servicing of cable and/or other building systems and components. Avoid excessive and sharp bends. Ensure manufacturer's recommended pulling tensions are not exceeded.

Grounding:

a. Ground all equipment per manufacturers' instructions, NEC Guidelines, EIA/TIA 568, and EIA/TIA 607.
b. Grounding Buss Bar to be provided by the electrical contractor adjacent to the technology equipment rack in EACH of the technology closets, the Local Exchange Carrier (LEC), and other areas shown in the technology/electrical plans.
c. In general, this consists of a # 6 Green Stranded Ground Wire from EACH equipment rack at the MTC/TC to the building structure and SECOND ground wire from the MTC/TC equipment rack to the “Grounding Buss Bar”.

Labeling:

a. Use an approved “Information Outlet Coding System”
b. Pan Net machine fed labels or prior approved equal self-adhesive typed labels shall be utilized as follows:
    i. Place labels on face plates adjacent to EACH jack.
    ii. Label all patch panel terminations at EACH jack location.
    iii. Label the EACH END of all cabling runs with a label at 3" to 5" from the termination at the patch panel and at the jack.
c. NOTE: All labels must be of the same, size, font and manufacturer.
d. Provide THREE samples of EACH information outlet labeled with a 2' Minimum of each cable terminated shall be required for approval.
e. Shall be submitted with “Initial Project Documentation”

C.3 Adjusting/Testing

Test all cabling and connections with specified equipment and certify as meeting all specifications. Provide hard copy test results for each cabling run in Technical Manual.

Provide CD of test reports with instructions and software for viewing.

C.4 Substantial Completion and Final Acceptance

Per provisions in the project documents.

99. Public Address System, Section 27 51 00.

A Description

A.1 General

The furnishing and installation of the Public Address System. The speakers shall be installed into the Platform Signage Panels and the Mezzanine Soffit. Contractor shall provide amplifier for the loud speakers in the new Train Shed area. The Public Address System shall be tied into the existing PA System located in the Station Building. The installation shall also include wiring and hardware as suggested on the architectural drawings, inferable there from and specified herein.

All work shall conform to or exceed the requirements of the following:

a. National Electrical Code, Article 800
b. Electronic Industries Association Standards
c. ANSI/IEEE 241 and ANSI/NEMA 250

Installer shall be an experienced specialty firm, regularly engaged for not less than five years in the installation of work similar to the type required herein, employing skilled personnel and with complete facilities to produce the work.

Manufacturer’s Warranty of 5 years

B Materials

B.1 Loudspeakers

The loudspeaker assembly shall come with double re-entrant horn, compression type loudspeaker, 25 and 70.7V universal transformer, 16 gage steel baffle and #8 x 32 'pin-in-torx' hardware.

Finish: Shall match sign finish.

The speaker unit shall be suitable for use in an outdoor environment, mounted on a vertical surface.

Program Material: Signal tone and voice.

Transformer: Integral to unit, 16W, 25V or 70.7V, 5 taps at –3dB levels.
16W, 8W, 4W, 2W, 1W

Speaker Type: Compression, re-entrant horn.

Average 110 dB-SPL, 1W / 1M.

Calculated Maximum System Output 122dB-SPL, 16W/ 1M.

Frequency Response 350 -10 kHz.

Nominal 90° Included Angle, Coverage Angle: -6 dB / 2 kHz, Half Space.

Power rating of 15 - 35 watts.

Peak Power Handling 105 watts.

Sensitivity 91 db at 1 watt.

Speaker installation shall be coordinated with Metal Fabricator and Sign Manufacturer.

B.2 Amplifier

The mixer/amplifier shall have five mixer input ports and shall be capable of operation from a 110/120 V, 50/60 Hz line. The amplifier shall meet the following performance criteria:

Power output shall be 500 W at less than 0.5% THD from 20 to 20k Hz (direct output) or 50 to 20k Hz(transformer output).

Frequency response shall be + 1 dB from 20 to 20k Hz (direct output) or 20 to 15k Hz (transformer output).

Load impedance shall be 4, 8, 5.2 (25 V line) or 40.8 (70.7 V line) ohms.

Load voltage shall be 21.9, 31.0, 25 or 70.7 V.

Output noise shall be 90 dB below rated output when all gain controls are off.

Plug-in accessory modules designed for use with the mixer/power amplifier shall utilize the latest in surface mount component technology and shall include microphone, line and special function models.

The mixer/amplifier shall be rack-mounted

Accessories and Auxiliary Equipment
All miscellaneous equipment, conduit, cabling, terminals, chime tone signal to comprise a complete and operable public address system.

B.3 Cabling
Cables shall have 300 volt insulation; shielding coverage shall be 100% and shield shall be grounded.

All conductors shall be tinned copper.

Cable for low level circuits (signal input) shall be No. 16 AWD min. with polyethylene insulation.

Speaker cable shall be 2 conductor No. 16 AWG min.

C Construction
C.1 Installation
Install all equipment and components in accordance to manufacturer's written instructions, in compliance with NEC, and with recognized industry practices, to ensure that all items comply with specifications and serve intended purposes.

Record serial numbers of all items furnished that are serialized. Serial numbers to be included in warranty manual.

All items must be complete as specified prior to substantial completion. It will be the responsibility of the contractor to ensure all cabling meets all specifications and standards.

Mount speakers to minimize acoustic feedback, acoustic resonance and vibration.

Identify wiring throughout the system and labels applied at all terminations and access fittings.

Furnish and install threaded bushings on conduit stubs as required to prevent damage to insulation or conductors PRIOR to installation of the cabling.

Use extreme care in handling, fishing, pulling and securing of all cabling to avoid damage to cabling and shielding. Avoid excessive and sharp bends.

Ensure manufacturer's recommended pulling tensions are not exceeded.

Conduit, raceways and outlet boxes, to be furnished as required by the electrical contractor.

Allow sufficient slack in cable to prevent premature deterioration of cable system components and to assist in the maintenance and servicing of cable and/or other building systems and components.

Fittings or connections are allowed only at the input and output of devices. Splicing shall not be accepted in any cable runs. The entire cable run shall be replaced in all such instances.

Cabling shall meet all applicable local, state, and federal building codes/laws.

C.2 Training
Prior to substantial completion, provide a minimum of two hour on-site, hands-on training for a minimum of two individuals.

Up to two hours of training on each system within the first three months of substantial completion dates and times to be determined by owner.

C.3 Adjusting/Testing:
Test the operation of each component and confirm the systems operate in compliance with the manufacturer’s requirements and specification.

100. Audio Hearing Loop System, Section 27 45 10.

A Description
A.1 Summary
An Audio Hearing Loop System configured with bi-directional arrays shall be installed on the three platforms and the mezzanine area. A single Audio Loop shall be installed in the tunnel for emergency use.

The Hearing Loop shall incorporate audio processing to maximize the intelligibility for individuals with T-coil equipped Hearing Aids.

The Audio Hearing Loop shall be tied into the Facility Public Address Systems.

Related Sections
a. Section 27 51 00 Public Address Systems
b. Division 26 – Electrical

A.2 System Description
Hearing Loop contractor shall furnish, install and test all cabling and equipment necessary for a complete and functioning Audio Hearing loop System as specified and indicated on drawings. Conduit, raceway and outlet boxes for the "Information Outlets" shall be provided as indicated in these project documents.

Furnish and install all cable, connections, racks and all other items necessary for a complete Hearing Loop system.

The system shall comply to IEC60118-4 and continuously deliver 9.2A (RMS) when excited with a 1kHz sine wave.

A.3 Project/Site Conditions
Examine areas and conditions under which all items are to be installed, and notify the project manager in writing of conditions detrimental to proper completion of the work. Do not proceed with that portion of the work affected until unsatisfactory conditions have been corrected in a manner acceptable to installer.

Contractor shall verify metal loss calculations and shall submit changes or modifications to the arrays if a negative metal loss is suspected.

A.4 Sequencing/Coordination
Hearing Loop contractor shall coordinate the receipt of all materials being provided by the owner to ensure installation proceeds without delays.

Hearing Loop contractor shall attend meetings as required by the project manager.

Hearing Loop contractor shall review and be familiar with the construction project.

A.5 Pathways for Hearing Loop Cabling
Electrical contractor shall provide the required conduit stubs, hand holes and back boxes shown on the technology plans. In general requirements are a 12"x12" square hand hole. Provide conduit as identified on Electrical Drawing.

A.6 Submittals
Initial Project Documentation: Hearing Loop contractor shall submit the following to the architect for approval prior to ordering equipment:

a. Catalog sheets with complete technical data for all materials being furnished. Exact part/model numbers being provided shall be highlighted.
b. Complete itemized "Bill of Material"
c. Calculations and Array configuration.

Complete listing of Charges as follows:

a. Hourly rate for maintenance.
b. Hourly rate for installation.

Documentation as follows:

a. The Hearing Loop contractor is an authorized dealer/distributor of the products and systems to be provided. (Initial layout and calculations are based on Ampetronic Equipment. Contractors submitting alternate equipment must provide revised array layout and Metal Loss calculations with other submittal data).
b. The technicians assigned to this project have been properly trained on the installation/maintenance of the model/type of cabling and equipment to be provided.

Final Project Documentation: Hearing Loop contractor shall submit the following project documentation to the project manager for approval prior to "Final Acceptance".

a. As built drawings shall include by not limited to the following:
    i. Any changes made to the system during installation.
    ii. Location of all cable, splices, pull boxes, etc. including number identification generated by AutoCAD text.
b. As built drawings shall be as follows:
    i. ONE copy in "Full Size" plans.
    ii. ONE copies on AutoCAD Disk(s).
    iii. ONE copy in REDUCED size - 11" X 17" (Included in the Technical Manual).
c. Hearing Loop contractor shall furnish ONE complete technical manual containing the following:
    i. Layout of the rack in the equipment room as installed. (Visio Professional or equivalent).
    ii. Layout of EACH device in the equipment rack as installed. (Visio Professional or equivalent).
    iii. REDUCED size - 11" X 17" as built drawing with the correct location of all information outlets and jack number generated by AutoCAD text.

A.7 Qualifications

Hearing Loop contractor shall have at least two years' experience in the installation of similar systems. The Hearing Loop contractor shall provide documentation upon request to certify that all assigned staff has attended training courses corresponding to the type of cabling and equipment specified herein.

Only AV Integration Firms/Dealers that have completed and are certified in the Level Two Integration and Commissioning of Hearing Loops are eligible to bid upon this portion of the bid. Being that AFILS (Audio Frequency Induction Loop Systems) are required to be commissioned and certified to the IEC 60118-4 standards, we require this specific level of certified individuals/dealers to complete this work.

Hearing Loop contractor shall currently be licensed to install low voltage electronic cabling systems in the State if applicable.

Hearing Loop contractor shall currently meet all manufacturers' requirements for the provision and installation of all equipment specified herein.

Hearing Loop contractor shall utilize and have operators trained in the utilization of the Hearing Loop test equipment.

A.8 Maintenance Service
Provide maintenance of cabling system for TWENTY years from date of final acceptance.

Warranty: Warrant the cabling system against malfunction due to component failure or improper installation for a period of TWO years from the date of final acceptance. When notified of a malfunction, proceed to immediately correct the situation by replacement or repair without cost to the owner. Extend manufacturer's warranties when necessary to achieve the full duration. Clearly indicate provisions in the warranty manual.

Response Time: Within the warranty period, Hearing Loop contractor will effect replacement of defective parts within one business day after receiving notification of a problem.

Warranty inspection: Prior to expiration of the FIRST year service period, arrange to make an inspection of the cabling system. Make adjustments and correct defects that exist to bring the system up to as-new specifications.

B Materials
At the Main Technology Closet provide the following:

A1000G Phased Array Kit (or Equal)
The phased array kit shall, in accordance to IEC60118-4, continuously deliver 9.2 A (RMS) when excited by a 1 kHz sine wave. The kit shall incorporate 2 drivers and one 90 degree audio phase shifter. The Kit shall reduce spill to no more than 1.5 feet. The kit shall have a frequency response of at least 80Hz to 6.5 Hz +/- 3dB with THD+N less than 0.2%. The kit shall incorporate audio processing to maximize the intelligibility for individuals with T-coil equipped Hearing Aids.

Each kit shall occupy 1 ru of rack space.

Quantity Required: Four (4)

Current Transformation Unit (CTU11) or equal shall be installed in Mezzanine Kit.

CABLE

Direct Burial Cable – (DBC2.5 or equal) – Used on Platforms and Mezzanine.

The direct burial cable shall be installed within the concrete pour.

The cable must have EPR-CSP HOFR insulation. The cable must be resistant to strong alkalis present in concrete to prevent loop failure due to corrosion of copper wires.

14 AWG Hearing Loop Cable - LA-396 or equal – Used in Tunnel
14 Gauge stranded copper cable with a green colored outer jacket. The cable will be wall mounted.

14 AWG Stranded Starquad Cable Array – Main Feed Cable From IT Room to Hearing Loop.

The "feed cable' in an Audio Frequency Induction Loop System is the section of wire from the amplifier to the loop and consists of the flow and return current paths from and to the amplifier terminals. For good performance, this section of wiring should be made up in such a way that unwanted generation of magnetic field is minimized.

It is the area enclosed by a loop of wire that generates magnetic field, and causes the wire to have inductance. Minimizing the effective area of unwanted wire loops will minimize unwanted magnetic field. If the feed cable is not correctly implemented, there is a risk of causing crosstalk to other circuits. In some cases, this could lead to feedback within the loop system or via other audio systems.

Note that the resistance of the feed cable is part of the overall system impedance, and should be taken into consideration when calculating the cable cross-sectional area (cable gauge) that can be used. The feed cable configuration is not affected by the wire size used for the cores. You can use stranded or solid cored cable – contractor will need to reverify feed cable prior to final installation.

Cabling:

a. Phased array system installed within first 2-3 in. the concrete using DBC2.5 direct burial cable.
b. System will overcome a potential of 10 dB of metal loss that might be involved in this environment with the steel pan reinforced concrete floor.
c. Feeder lines will be run using starquad cable within conduit running back to the IT room racks. These lines must be kept separate from any power or audio lines.

Equipment Racks:

a. Main Technology Closet Rack Assembly, Vertical Organizer
b. Chatsworth 30161-703..BLACK or Equal
c. (Quantity ONE at the Technology Closet)
d. Provide 1½" stringers and all required connectors, hardware, bolts, etc.
e. Secure rack to other racks within Technology Closet.

B.1 General

All products bid shall be the most current and up-to-date versions available, unless otherwise specified.

Hearing Loop contractor shall provide written notification to the project manager, prior to submitting the bid, of any discrepancies in model or part numbers specified.

Hearing Loop contractor shall provide written notification to the project manager, prior to bidding, of the announced discontinuation or replacement of any items specified herein.

Hearing Loop contractor shall provide all necessary supplies, mounting hardware and accessories required to install the materials specified herein.

B.2 Product Substitutions

The Hearing Loop design is based on Ampetronics technology with assistance of Listen Technologies. The Hearing Loop design has been specifically engineered to this space and only pre-approved substitutions will be accepted in either the manufacturer of the Hearing Loop Driver, nor may the installation materials be replaced.

C Construction

C.1 General

Install all equipment and components in accordance to manufacturer's written instructions, in compliance with NEC, and with recognized industry practices, to ensure that all items comply with specifications and serve intended purposes.

All cabling and equipment shall be installed in accordance to good engineering practices as established by the EIA and the NEC. Cabling shall meet all applicable local, state, and federal building codes and laws.

Record serial numbers of all items provided that are serialized. Refer to PART 1 - SUBMITTALS for presentation format. To be completed prior to Final Acceptance.

All items must be complete as specified prior to Final Acceptance. It will be the responsibility of the Hearing Loop contractor to ensure cabling and equipment meets all specifications and standards defined herein.

It will be the responsibility of the Hearing Loop contractor to ensure that any cable run is not adversely effected by metal, noise generating equipment or other conditions.

C.2 Installation

Cabling - General:

a. Furnish and install starquad cabling runs between the MTC/TC to each loop array as specified on drawings. A dedicated cabling run shall be utilized for each Array.
b. Furnish and install Direct Bury Cable in the top 2-3 inches of the concrete. Contractor will be responsible for coordinating with the construction team to ensure installation takes place when required.
c. Install Array Kits in IT room, following Manufacturer’s best practices.

d. Interface with Building PA system to direct onto the Loops.
e. Tighten connectors and terminals, including screws and bolts, in accordance to equipment manufacturer's published torque tightening values for equipment connectors.

Grounding:

a. Ground all equipment per manufacturers' instructions, NEC Guidelines, EIA/TIA 568, and EIA/TIA 607.
b. Grounding Buss Bar to be provided by the electrical contractor adjacent to the technology equipment rack in EACH of the technology closets, the Local Exchange Carrier (LEC), and other areas shown in the technology/electrical plans.
c. In general, this consists of a #6 Green Stranded Ground Wire from EACH equipment rack at the MTC/TC to the building structure and SECOND ground wire from the MTC/TC equipment rack to the "Grounding Buss Bar".

C.3 Adjusting/Testing

Test all sound levels, cabling and connections with specified equipment and certify as meeting all specifications. Adjust sound levels for Db loss based on final reading and structural construction.

C.4 Substantial Completion and Final Acceptance

Per provisions in the project documents.

101. Fire Detection and Alarm System.

A Description

A.1 Summary

Work covered by this specification section of includes furnishing of all labor, equipment, materials, and performance of all operations associated with installation of Fire Alarm Systems as shown on drawings and as specified.

In general, work consists of: Furnish and install a complete Multiplex/Intelligent Fire Alarm System as described herein and as shown on drawings; to be wired, connected, and left in first class operating condition.

Include sufficient control panels, annunciator panels, manual stations, automatic heat detectors, smoke detectors, alarm indicating appliances, terminations, electrical boxes, and all other necessary material for complete operating systems.

Related Sections:

a. Applicable provisions of Section 26 00 00 shall govern all work under this section.

A.2 References

Complete fire alarm installation shall conform to applicable sections of Codes and Standards as follows:

National Fire Protection Association (NFPA):

a. NFPA 70 - National Electrical Code (NEC) Generally, and Article 760 in particular.
b. NFPA 72 - Local Protective Signaling Systems;
c. Auxiliary Signaling Systems.
d. Remote Station Systems.
e. Proprietary Signaling Systems.
f. Automatic Fire Detectors.
g. Testing Procedures for Local, Auxiliary, Remote Station, and Proprietary Protective Signaling Systems.
h. NFPA 101 – Life Safety Code.

National Electrical Manufacturer's Association (NEMA).

Underwriters' Laboratories, Inc. (UL):

a. UL-38 Manually Actuated Signaling Boxes.
b. UL-217 Smoke Detectors for Single and Multiple Stations.
c. UL-268 Smoke Detector for Fire Protective Signaling Systems.
d. UL-464 Audible Signaling Appliances.
e. UL-521 Heat Detectors for Fire Protective Signaling Systems.
f. UL-864 Control Units for Fire Protective Signaling Systems.
g. UL-1481 Power Supplies for Fire Protective Signaling Systems.
h. UL-1971 Visual Signaling Appliances.

A.3 Submittals

Section 26 00 00 - Basic Electrical Requirements - Submittal Procedures: Procedures for submittals.

Prior to programming system, submit a list of all device addresses with location labeling as they will appear in 2 line, 40 character display of fire alarm panel and annunciator. This list will be modified as needed by owner and returned to contractor for final programming in to system.

Standby battery power calculations, showing current draws for every device and module during standby and alarm and trouble conditions.

Submit shop drawing for fire alarm system to local AHJ for approval and obtain approval before submitting to engineer. Provide letter from AHJ stating they approved shop drawing in shop drawing submitted to engineer.

Submit following information for approval prior to ordering any equipment:

a. Manufacturer's catalog specification cuts and printed descriptive literature on all components being provided.
b. Bill of materials listing part number and quantity of all components and devices.
c. Description of operations of all functions of system.
d. Type of system and required modules to make up system.

e. Component and module wiring diagrams.
f. Block diagrams showing layout and operation of entire system.
g. Schematic drawings, specific to this project only, of all circuits from field devices to required terminal strip(s) associated with control panel.
    i. Diagrams shall show schematic wiring of equipment; and all connections to be made to devices.
    ii. Terminal connections in equipment shall be numbered to correspond to diagrams for use in making connections.
    iii. Wiring diagrams shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are same on all drawings.
    iv. All drawings must be submitted and approved by engineer before ordering or fabrication starts, but such approval will not waive any specification requirements unless specifically stated.

A.4 Closeout Submittals

Section 26 00 00 - Basic Electrical Requirements - Execution Requirements: Closeout procedures.

Project Record Documents:

a. Contractor shall submit record drawings for entire work done under this project prior to final payment. These drawings shall show:
    i. Locations and addresses of alarm initiation devices, audio and visual devices, status monitoring devices, supervised signaling devices, and auxiliary controls devices.
    ii. Conduit layout and size.
    iii. Number/size/type of conductors.
    iv. System riser diagrams.
    v. Location of end-of-line devices.
    vi. List of custom labels as installed for each initiating device address.
b. Riser diagrams shall include location of emergency 120VAC panel, panel designation and circuit number used to feed the fire alarm panel. Also, indicate if panel is backed up by an emergency generator.
c. Riser diagrams shall include locations of devices (indicating and initiating) and initiating devices addresses.

Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

a. All maintenance and operating instructions shall be provided by contractor for system.
b. These manuals shall include a material guide, which shall contain replacement part numbers and description of all components used. If this information is included in an instruction section for any of equipment, it will not be necessary to duplicate list. In either case, parts list shall be associated with its respective chassis, modules or kit wherein it is found.

c. A total listing of parts without such grouping will not be acceptable. In addition, specific operating instruction for each panel shall be framed and posted next panel.

A.5 Qualifications
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 UL label.

All equipment shall be supplied by a company specializing in fire alarm and smoke detection systems with 5 years documented experience. Company shall be an authorized distributor of proposed equipment.

All work shall be performed by a licensed contractor regularly engaged in installation and servicing of fire alarm systems. Proof of 5 years documented experience and of factory authorization to furnish and install equipment proposed shall be furnished prior to contract award, if required by owner.

Contractor shall be located within 100 miles or less from project site.

A.6 Product Delivery, Storage and Handling
Deliver, store and handle products under provisions of Section 26 00 00.

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 owner at preconstruction meeting for storage of equipment at project site.

A.7 Extra Materials
Section 26 00 00 - Basic Electrical Requirements - Execution Requirements: Spare parts and maintenance products.

Furnish three of each type of automatic smoke detector.

A.8 Supervision
Fire alarm system shall contain independently supervised initiating device circuits.

Alarm activation of any initiation circuit shall not prevent subsequent alarm operation of any other initiation circuit.

There shall be supervisory service initiation device circuits for connection of all sprinkler flow and tamper switches.

Device activation shall be appropriately annunciated at control panel and remote annunciator.

There shall be independently supervised and independently fused indicating appliance circuits for alarm horn/strobe units.

Disarrangement conditions of any circuit shall not affect operation of other circuits.

Auxiliary manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble.

Auxiliary circuits for addressable relays shall be supervised, so that a blown fuse or an open in circuit shall be visibly and audibly annunciated.

LCD annunciator panel shall be supervised. Any ground, short, or open in wiring to fire alarm control panel, as well as any malfunction of annunciator panel itself shall be appropriately annunciated at control panel.

Each independently supervised circuit shall include a discrete visible amber "Trouble" LED to indicate disarrangement conditions per circuit.

Incoming power to system shall be supervised so that any power failure must be audibly and visually indicated at control panel and remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present.

System batteries shall be supervised so that a low battery condition or disconnection of any battery shall be audibly and visually indicated at control panel and remote annunciator.

System Modules shall be electrically supervised for module placement. Should a module becomes disconnected, system trouble indicator shall illuminate and audible trouble signal shall sound.

System shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

A.9 Power Requirements

Control panel shall receive 120 VAC power via a branch circuit in building's emergency load panel.

This branch circuit shall have a "breaker lock" to prevent accidentally de-energizing of power to fire alarm panel. Circuit breakers shall be painted red and labeled "FIRE ALARM".

Panel shall include a disconnect switch for AC power inside an enclosure near panel or within panel itself. This switch shall be labeled “Fire Alarm Power Disconnect”.

Control panel shall include electrical power surge and transient protection.

System shall include sufficient back-up battery capacity to operate entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of 24 hours with 10 minutes of alarm operation at end of this period.

Each system shall automatically transfer to standby batteries upon power failure.

All battery charging and recharging operations shall be automatic.

Panel shall include a power-limited, filtered and regulated battery charger.

a. Charger shall be combination high rate/float maintenance type.
b. Charger shall charge a fully discharged battery to 70 percent in 12 hours.
c. 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.
d. Charger shall provide 5 AMPS regulated 24VDC for peripheral devices requiring +/-5 percent regulation and 8 AMPS at 24VDC for standard peripheral devices.
e. Charger shall be compatible with lead acid and Ni-Cad batteries.

All external circuits requiring system operating power shall be 24VDC and shall be individually supervised and fused at control panel.

A.10 Isolated Loop Circuit Protectors (ILCP)

Fire alarm control panel shall include Isolated Loop Circuit Protector (ILCP) on all circuit which extends beyond building.

These circuits include, but limited to, initiating device circuits, alarm notification appliance circuits, and signaling line circuits.

ILCP shall be located as close as practical to point where circuits leave or enter a building.

ILCP grounding conductor shall be a No. 12 AWG wire having a maximum length of 25 feet. Wire shall be run in a straight line and connected to building grounding electrode system.

ILCP shall have a line to line response time of less than one nanosecond. Spark gap devices or devices incorporated in or installed within control panel in lieu of ILCP are not acceptable.

A.11 Operation of Multiplex/Intelligent Fire Alarm Systems

System alarm operation subsequent to activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:

a. All audible alarm indicating appliances shall sound in a temporal code-three ringing pattern until silenced by alarm silence switch at control panel or at remote annunciator.
b. All visual alarm indicating appliances shall flash continuously until system is reset.
c. Any subsequent alarm shall reactivate alarm audible indicating appliances.
d. All doors normally held open by door control devices shall release.
e. A supervised signal to notify local fire department shall be activated.
f. Mechanical controls shall activate or deactivate air handling systems in accordance to NFPA-90A.
g. System alarm LED shall flash on control panel and remote annunciator until alarm has been acknowledged. Once acknowledged, this same LED shall latch on.
h. A subsequent alarm received from another device shall flash system alarm LED on control panel and remote annunciator. LCD display shall show new alarm information.
i. A pulsing alarm tone shall occur within control panel and remote annunciator until the event has been acknowledged.

System shall have a single key that will allow operator to display all alarms, troubles, and supervisory service conditions including time and date of each occurrence.

Alarm shall be displayed on an 80-character LCD display as follows:

a. 40 characters for:
    i. Point address and loop number.
    ii. Type of device.
    iii. Point status.
b. 40 characters for:
    i. Custom location label.

A.12 Smoke Detection Operation

Activation of any system smoke detector shall initiate an alarm verification operation whereby the panel will reset activated detector and wait for a second alarm activation.

If, after 20 seconds and within 1 minute after resetting, a second alarm is reported from same or any other smoke detector, system shall process alarm as described previously.

If no second alarm occurs within 1 minute, system shall resume normal operation.

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.

Alarm verification operation shall be selectable by device or zone.

Multiplex/intelligent system shall have capability of displaying number of times (tally) a detector has gone into a verification mode.

Smoke detectors shall be smoke density measuring devices having no self contained alarm set point (fixed threshold).

a. Alarm decision for each detector shall be determined by control panel.
b. Control panel shall determine condition of each detector by comparing detector's value to stored values.

Control panel shall maintain a moving average of detectors' smoke chamber value to automatically compensate (move threshold) for dust and dirty conditions that could affect detection operations.

System shall automatically maintain a constant smoke obscuration sensitivity for each detector (via floating threshold) by compensating for environmental factors.

Photoelectric detector's smoke obscuration sensitivity shall be adjustable to within 0.3 percent of either limit of UL window (0.5 percent to 4.0 percent) to compensate for any environment.

System shall automatically indicate when an individual detector needs cleaning.

When a detector's average value reaches a predetermined level, a trouble MESSAGE shall be audibly and visibly indicated at control panel for individual detector.

Additionally, LED on detector base shall glow steady giving a visible indication at detector's location.

If troubled condition is left unattended, and detector's average value increases to a second predetermined value, another trouble message shall be indicated at control panel for individual detector.

To prevent false alarms, these trouble conditions shall in no way decrease amount of smoke obscuration necessary for system activation.

For scheduling of maintenance, control panel shall be able to generate a message indication for any detector approaching a trouble condition due to dirt or contamination.

Control panel shall continuously perform an automatic self-test routine on each detector, which will functionally check detector electronics and ensure accuracy of values being transmitted to control panel.

Any detector that fails this test shall indicate a "Self Test Failed" trouble condition with detector location at control panel.

An operator at control panel, having a proper access level, shall have capability to manually access following information for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity value selected.
e. Peak detection values.
f. Detector range (normal, dirty)

Values shall be in "percent of smoke obscuration" format so that no interpretation is required by operator.

An operator at control panel, having a proper access level, shall have capability to manually control following for each detector:

a. Clear peak detection values.
b. Enable or disable the detector.
c. Clear verification tally.
d. Establish alarm sensitivity.
e. Control a detector's relay driver output.

It shall be possible to program control panel to automatically change sensitivity settings of each detector based on time-of-day and day-of-week. There shall be three sensitivity settings available for each detector.

Control panel shall have capability of being programmed for a pre-alarm or two-stage function. This function allows an indication to occur when, for example, a 3 percent detector reaches a threshold of 1.5 percent smoke obscuration.

Control panel shall clear a “detector dirty” trouble after a detector has been removed from its base cleaned and replaced.

A.13 Elevator Shunt Trip

After an elevator machine room or elevator shaft heat detector is activated, elevator control panel shall deactivate shunt trip breaker supplying power to elevator.

Specific elevator shaft zone shall be put into alarm at control panel, and sound general fire alarm.

A.14 System Response
Maximum elapsed time from sensing a fire alarm at a non-smoke detector initiating device or a second smoke detector until it is recorded at control panel and remote annunciator, shall not exceed 5 seconds and not to exceed 15 seconds for remote station reporting.

Maximum elapsed time for first smoke detector shall not exceed 35 seconds including verification period and not to exceed 40 seconds for remote station reporting.

A.15 Manual Drill Operation
A manual evacuation (drill) switch shall be provided to operate alarm indicating appliances without causing other control circuits to be activated. However, should a true alarm occur, all alarm functions would occur as described previously.

A.16 LED and LCD Test Operation
Activation of Lamp Test switch shall turn on all LED indicators, LCD display, and local sounder and then return to previous condition.

A.17 System Diagnosis
System shall include special software to detect, diagnose and report failures and isolate such failures to a printed circuit board level.

A.18 Watch Dog Timers
System shall include independent "Watch-Dog" timers to detect and report failure of any microprocessor circuit, memory, or software.

A.19 Silent Walk Test with History Logging Operation
Actuation of "Walk Test" switch/program at control panel shall activate "Walk Test" mode of system, which shall cause following to occur:

a. Fire department circuit connection shall be bypassed.
b. Control relay functions shall be bypassed, such as door holders, elevator capture, fan shut down.
c. Audio and visual circuits shall be bypassed.
d. Control panel shall show a trouble condition.
e. Alarm activation of any initiation device shall silently logged as an alarm condition in historical data file. Panel shall automatically reset itself after logging of alarm.
f. Any momentary opening of an initiating or indicating appliance circuit shall be silently logged as a trouble condition in historical data file. Panel shall automatically reset itself after logging of trouble condition.

If system becomes inactive for a period of longer than 10 minutes, panel shall default to normal fire alarm functions.

Panel shall have capability of dividing system into distinctive walk test groups, a minimum of 8 groups.

B Materials

B.1 Control Panel

Manufacturers:

a. Simplex Time Recorder Company.
b. Notifier.
c. Edwards Systems Technology (EST)
d. Siemens.
e. Mircom.
f. Substitutions: In accordance to Section 26 00 00 - Basic Electrical requirements - Product Requirements.

B.2 Enclosures

Provide cabinets of sufficient size to accommodate aforementioned equipment.

Cabinet shall be equipped with locks and transparent door panel providing tamper proof enclosure yet allowing full view of various lights and controls as required above.

B.3 Multiplex/Intelligent Fire Alarm Control Panel

Control Panel shall include hardware and software that are compliant with year 2000 computing standards.

Control Panel shall be modular, expandable with solid state, microprocessor based electronics. It shall display through front viewing window only those primary controls and displays essential to operation during a fire alarm condition.

Control panel shall provide following features as standards:

a. Support intelligent (analog) detection devices.
b. Number of initiating device loops required for specified quantity of initiating devices plus 1 spare loop for each 5 active loops. Each active loop shall include 5 percent spare capacity.
c. Number of indicating appliance (horn) circuits required for specified quantity horns plus 1 spare circuit for each 10 active circuits. Each active circuit shall include 25 percent spare capacity.
d. Number of indicating appliance (strobe) circuits required for specified quantity of strobes plus 1 spare circuit for each 10 active circuits. Each active circuit shall include 25 percent spare capacity.
e. 80-character liquid crystal display.
f. Printer interface.
g. History log file with a minimum of 600 events.
h. Field programmable.
i. Drift compensation.
j. Sensitivity display in percent.
k. Sensitivity adjustment.
l. Day/night sensitivity adjustment.
m. Auto detector test to meet NFPA 72.

n. Alarm verification with tally counter.
o. Silent walk test.
p. Maintenance alerts.
q. Other features as described below.

Multiplex/intelligent system shall provide ability to recall alarms and trouble conditions in chronological order for purpose of recreating an event history.

Under normal condition, viewing window shall display a "System is Normal" message and current time and date.

Should an abnormal condition be detected, appropriate LED (Alarm, Supervisory or Trouble) shall flash. Panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

LCD shall display following information relative to abnormal condition of a point in system prior to acknowledgement.

a. 40 characters for:
    i. Point address and loop number (i.e. 555-L5).
    ii. Type of device (i.e. smoke, pull station, water-flow).
    iii. Point status (i.e. alarm, trouble).
b. 40 characters for:
    i. Custom location label (i.e. 4th Floor - Room 444).

Keyboards or keypads shall not be required to operate system during fire alarm conditions. Software functions shall be provided as follows:

a. Setting of time and date.
b. LED testing.
c. Alarm, trouble, and abnormal condition listing.
d. Enabling and disabling of each monitor point separately.
e. Activation and deactivation of each control point separately.
f. Changing operator access levels.
g. Walk Test enable.
h. Running diagnostic functions.
i. Displaying historical logs.
j. Point listing.

Hardware functions shall be provided as follows:

a. Acknowledge alarm or trouble.
b. Silence alarm or trouble.
c. Reset system after alarm.
d. Connect/disconnect fire department tie.
e. Provide manual evacuation (drill).
f. Bypass elevator interlock.

g. Bypass door holders.
h. Supervise system.
i. Allow computer interface.

Status Indicators And Diplays:

a. 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 key has been pressed properly. Visual display shall distinguish between alarm, trouble and supervisory conditions.
b. Indicators and displays shall be visible through front viewing window as follows:
    i. One red system alarm LED.
    ii. One yellow supervisory service LED.
    iii. One yellow trouble LED.
    iv. Green "power on" LED.
    v. Eighty-character liquid crystal display.
c. 2-line by 40-character liquid crystal display shall be backlit for enhanced readability. So as to conserve battery standby power, it shall not be lit during an AC power failure unless an alarm condition occurs or there is keypad activity.
d. A cursor shall be visible on LCD when entering information.
e. Scrolling through menu options or lists shall be accomplished in a self-directing manner in which prompting messages shall direct user. These controls shall be located behind an access door.
f. Status data shall be available on this display as follows:
    i. Initiating device circuits.
    ii. Indicating appliance circuits.
    iii. Auxiliary relays.
    iv. Feedback points.
    v. Primary State of point.
    vi. Zone information.
    vii. Class "A" Status.
    viii. Current priority of outputs.
    ix. Disable/Enable status.
    x. Verification tallies of initiating devices.
    xi. Automatic/Manual Control Status of output points.
    xii. Acknowledge status.

Controls

a. Controls (one switch per function per system) shall be visible through front viewing window as follows:
    i. Alarm Acknowledge key.
    ii. Trouble Acknowledge key.
    iii. Alarm Silence key.
    iv. System Reset key.

b. Controls shall be accessible with front door open, though not visible through front viewing window as follows:
    i. Fire department disconnect/switch.
    ii. Manual evacuation (drill).
    iii. Elevator bypass.
    iv. Fan shut down override/bypass switches.
    v. Door holder release bypass.
    vi. Key pad for data input and microprocessor control.

LED Supervision

a. All slave modules LEDs shall be supervised for burnout or disarrangement. Should a problem occur LCD shall display module and LED location numbers to facilitate location of that LED.

Acknowledgement

a. Two methods of acknowledgment for each abnormal condition shall be provided. One may be chosen depending on NFPA requirements.
b. Acknowledge one event at a time from an unacknowledged list of events.
c. Pressing appropriate acknowledge button shall display first unacknowledged condition in appropriate list (either alarm, supervisory or trouble), and require another acknowledge button. Press to acknowledge only displayed point.
d. After all points have been acknowledged, LEDs shall glow steadily and Sonalert will be silenced.
e. Total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically, with end of list indicated by an end of list message "END of LIST".
f. Pressing appropriate acknowledge button shall globally acknowledge all points.
g. All acknowledge functions shall be behind locked door or pass-code protected.
h. In pass-code protection, if user has insufficient privilege to acknowledge such conditions, a message shall indicate insufficient privilege but allow user to view points without acknowledging them. Should user have sufficient privilege to acknowledge, a message will be displayed informing user that condition has been acknowledged.

Silencing

a. If an alarm condition exists and "Alarm Silence" button is pressed, all alarm signals shall cease operation. Strobes shall remain active until system is reset.
b. If trouble conditions exist in system and "Trouble Silence" button has been pressed, aural trouble signal shall cease, but shall resound at time intervals to act as a reminder that fire alarm system is not in a normal operating mode. Both time interval and trouble reminder signal shall be programmable to suit owner's application.

Reset

a. “System Reset” button shall be used to return system to its normal state after an alarm condition has been remedied.
b. Should an alarm condition continue to exist, system shall provide indications that resetting cannot be completed and shall remain in an abnormal state. Sonalert and Alarm LED shall remain activated.
c. Display shall indicate total number of alarms and troubles present in system along with a prompt to use ACK keys to review points. These points shall not require acknowledgment if they were previously acknowledged.
d. Should Alarm Silence Inhibit function be active, system shall ignore all key presses. An indication of enabling and disabling inhibit state shall be provided as a feedback to operator.

Access Levels

a. There shall be three access levels with level 4 being highest level.
    i. Level 1 actions shall not require a pass-code.
    ii. Pass-codes shall consist of up to five digits.
    iii. Changes to pass-codes shall only be made by authorized personnel.
b. In order to maintain security when entering a pass-code, digits entered shall not be displayed but a cursor shall move along filling position with an X to indicate that digit has been accepted. All key presses shall be acknowledged by a local audible sound.
c. When a correct pass-code is entered, the system shall indicate to operator that "Access Granted". New access level shall be in effect until operator manually logs out or keypad has been inactive for five minutes.
d. Operator entering an invalid code shall be notified with message, "Incorrect Pass-Code", and shall be allowed up to three chances to enter a valid code. After three unsuccessful tries, message, "Access Denied", shall be displayed. Current level shall not be altered, and operator shall no longer be in menu option.
e. Access to a level shall allow operator to perform all actions within that level plus all actions of lower levels, but no actions of higher levels.
f. Keys/switches shall have access levels associated with them as follows:
    i. Alarm Silence.
    ii. System Reset.
    iii. Set Time/Date.
    iv. Manual Control.
    v. On/Off/Auto Control.
    vi. Disable/Enable.
    vii. Programming functions.
    viii. Clear Historical Alarm Log.
    ix. Clear Historical Trouble Log.
    x. Walk Test.
    xi. Change Alarm Verification.

g. Acknowledge keys shall also require privileged access to acknowledge points. If operator presses an (ACK) key with insufficient access, an error message shall be displayed. Points shall scroll with (ACK) key presses to view points on list, but points shall not get acknowledged in database.

Point Listing

a. For maintenance purposes, following lists shall be available from point lists menu:
    i. All points list by address.
    ii. Monitor point list.
    iii. Signal/speaker list.
    iv. Auxiliary control list.
    v. Feedback point list.

History Logging

a. System shall be capable of logging and storing last 400 events (alarm and trouble) in a history log. These events shall be stored in a battery protected random access memory. Each recorded event shall include time and date of that event's occurrence.
b. Historical alarm log events shall be stored as follows:
    i. Alarms.
    ii. Alarm Acknowledgment.
    iii. Alarm Silence.
    iv. System Reset.
    v. Alarm Historical log cleared.
c. Historical trouble log events shall be stored as follows:
    i. Trouble conditions.
    ii. Supervisory alarms.
    iii. Trouble acknowledgment.
    iv. Supervisory acknowledgment.
    v. Alarm Verification tallies.
    vi. Walk Test results.
    vii. Trouble Historical log cleared.

Silent Walk Test With History Logging

a. System shall be capable of being tested by one person. While in testing mode, alarm activation of an alarm-initiating device shall be silently logged as an alarm condition in historical data file. Panel shall automatically reset itself after logging of alarm.
b. Momentary disconnection of an initiating or indicating device circuit shall be silently logged as a trouble condition in historical data file. Panel shall automatically reset itself after logging of trouble condition.
c. Should silent walk-test feature be on for an inappropriate amount of time (30 minutes max.), it shall revert to normal mode automatically.
d. Panel shall have capability of dividing system into distinctive walk test groups, a minimum of eight groups.

e. Should an alarm condition occur from an active point, not in walk test mode, it shall perform operations described above.
f. After testing is considered complete, testing data may be retrieved from system in chronological order to ensure device/circuit activation.

Computer Interface

a. Fire Alarm Control Panel shall operate as a proprietary local system with capability of sending status data to and receiving control data from a Central Processing Unit (CPU).
b. CPU would monitor all alarms and troubles and would control selected functions of each Fire Alarm Control Panel.
c. CPU shall supervise all data communication wiring between CPU and Fire Alarm Control Panel for opens, shorts and grounds.

Field Programming

a. System shall be fully programmable, configurable, and expandable in field without need for special tools or PROM programmers and shall not require replacement of memory IC's.
b. All programming may be accomplished through standard control panel keyboard or a keyboard at printer, or use of a PC. All programs shall be stored in non-volatile memory.
c. All programming or reprogramming shall be done by supplier at no charge until system is accepted by owner.

Intelligent Network

a. System must provide communications with intelligent initiating and control devices individually. These devices shall be individually annunciated at control panel. Annunciation shall include following conditions for each point:
    i. Alarm.
    ii. Trouble.
    iii. Open.
    iv. Short
    v. Device missing/failed
b. All intelligent devices shall have capability of being disabled or enabled individually.
c. There shall be no limit to number of detectors, stations, or addressable modules, which may be activated or "in alarm" simultaneously.
d. Multiple intelligent devices shall be connected to a single pair of wires. Systems that require factory pre-programming to add or delete devices are unacceptable.
e. Communication format must be a completely digital poll/response protocol to allow t-tapping of circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for data transmission portion of protocol. Systems that do not utilize full digital transmission protocol are not acceptable.

B.4 LCD Remote Annunciator Panel
Where shown on drawings, provide and install an 80-character LCD point annunciator.

Annunciators shall have a black finish and shall provide “System Alarm” and “System Trouble” indications on 80-character LCD readout.

Annunciator shall communicate to control panel over one twisted shielded wire pair. Operating power shall be 24VDC and be fused at control panel. LED annunciators are not considered equal and will not be accepted.

All wiring between annunciator panel and fire alarm control panel shall be supervised for opens, grounds and shorts.

Under normal operating conditions, LCD shall indicate time, date and "System is Normal" label.

During abnormal conditions, LCD shall indicate type and number of abnormal conditions such as alarms, troubles, and supervisory services. LCD shall display a custom location label for each abnormal condition identical to display at control panel.

LCD annunciator shall provide:

a. Control push-button switches - for; alarm silence, trouble silence, system reset and LED and LCD test.
b. Tone Alert - Duplicates control panel tone alert during alarm and trouble conditions.
c. System trouble LED.
d. System alarm LED.
e. Power on LED.

B.5 Multiplex/Intelligent Peripheral Devices
All devices shall be supervised for trouble conditions. System control panel shall be capable of displaying type of trouble condition (open, short, device missing/failed). Failure of a device shall not hinder operation of other system devices.

Device Identification:

a. Each intelligent device must be uniquely identified by an address code entered on each device’s base at time of installation. Use of jumpers to set address shall not be acceptable. This address along with loop number shall be indicated, and be visible from ground, on device's housing or base in field using permanent marking.
b. Location of end-of-line device shall be indicated on device that containing same.
c. Device identification schemes that do not use uniquely set addresses but rely on electrical position along communication channel are unacceptable. These systems cannot accommodate t-tapping and addition of an intelligent device between existing devices requires re-programming all existing devices beyond added device.

d. System must verify that proper type device is in place and matches desired software configuration.

Intelligent Detector Bases:

a. Bases shall be suitable for either smoke or heat detector mounting.
b. Either base or head shall contain electronic circuits that communicate detector's status (normal, alarm, sensitivity status, trouble, etc.) to control panel over two wires. Same two wires shall also provide power to base and detector. Contacts between base and head shall be of bifurcated type using spring-type, self-wiping contacts.
c. Base shall be lockable. Locking feature must be field removable when not required.
d. Upon removal of detector's head, a trouble signal shall be transmitted to control panel.
e. Detector base shall be sealed against rear airflow entry.
f. Each detector's base or head shall contain LED(s), which shall flash when detector is being scanned by control panel. LED(s) shall turn on steady when detector is in an alarm condition.
g. Each base shall provide means to allow for function testing of detector at detector's location.
h. Base shall be common with heat detector and smoke type detectors and shall be compatible with other intelligent detectors, addressable manual stations, and addressable modules on same circuit.

Intelligent Detectors – General:

a. Smoke and heat detectors must be approved by engineer prior to installation.
b. Intelligent detectors shall be low-profile type.
c. Smoke detectors shall be listed for sensitivity testing from control panel. Sensitivity test results shall be logged and downloaded to a printer.
d. Detectors shall be plug-in units, which mount to a common base, and shall be UL 268 approved.
e. Detector shall be a 24VDC type which is compatible with fire alarm panel and obtains its operating power from supervisory current in fire alarm detection loop.
f. 24 VDC detector may be reset by actuating control panel reset switch.
g. To minimize false alarms, voltage and RF transient suppression techniques shall be employed.
h. Smoke detectors shall be installed on circuits with alarm verification modules.
i. Smoke detectors shall include an insect screen.
j. Smoke detectors shall communicate actual smoke chamber values to system control panel.
k. If field conditions so require, smoke detection devices shall be covered with plastic bags after installation to maintain cleanliness. Plastic bags shall be red for quick visual identification for removal at time of occupancy.

Intelligent Ionization Smoke Detectors:

a. Detectors shall be of dual chamber type: one chamber for sampling, and one chamber for reference to provide stability over wide changes in environmental conditions such as temperature, humidity and pressure.
b. Detectors shall sense product-of-combustion and report measured level of such products in analog form to control panel.

Intelligent Photoelectric Smoke Detectors:

a. Detectors shall contain no radioactive material.
b. Detectors shall be of the solid state photoelectric type. and shall operate on light scattering photodiode principle using a pulsed infrared LED light.

Intelligent Thermal Detectors:

a. Detectors shall be a combination rate-of-rise and fixed temperature (135 degrees F unless noted).
b. Detectors shall sense within a temperature range of 32 degrees F to 158 degrees F. Control panel shall be capable of sensing either a set point of 135 degrees F, or a rate-of-rise of 15 degrees F per minute for fire sensing.
c. For utility sensing, a set point may be chosen within stated range and control panel programming shall be capable of using that information to determine specific response such as warning of failure of local temperature controls.

Pull Stations:

a. Pull stations shall contain circuits that communicate station's status (alarm, normal) to control panel over two wires, which also provide power to pull station. Address shall be field programmable on station.
b. Manual stations shall be a double action constructed of high impact, red Lexan with raised white lettering and a smooth high gloss finish.
c. Station shall mechanically latch upon operation and remain so until manually reset a key common to all system locks. Stations which use Allen wrenches or special tools to reset shall not be accepted.
d. Manual station shall be fitted with screw terminals for field wire attachment.

Interface Modules – General:

a. Addressable Interface Modules shall receive their 24VDC power from a separate two wire circuit provided by an appropriate power supply.
b. Module shall be available in either a Class B or Class A supervision version.
c. In Class B version, wiring shall be supervised by an end-of-line device.
d. In Class A version, wiring shall be looped back and connected to module to allow continual operation of controlled devices even if wiring sustains a single break.
e. Interface modules shall be supervised and uniquely identified by control panel. Device identification shall be transmitted to control panel for processing according to program instructions.
f. Should interface modules become non-operational, tampered with, or removed, a discrete trouble signal, unique to device, shall be transmitted to, and annunciated at control panel.

g. Interface modules shall be capable of being programmed for its "address" location on intelligent device initiating circuit.
h. Interface modules shall be compatible with addressable manual stations and intelligent detectors on same intelligent initiating circuit.

Interface Modules - Supervised Control:

a. Interface Modules shall be suited for control of indicating appliances, door holders, and AHU systems.
b. For signals, speakers, fire fighter phone jacks and other device control with Class B or Class A wiring supervision, interface module shall provide double-pole/double-throw relay switching that can be used to connect any of following through easily replaceable 2 amp fuses:
c. A zone of signals to a power source.
d. Speakers to an audio source.
e. Fire fighter phone jacks to a communications channel.
f. A variety of controlled devices to appropriate controlling circuits.
g. These interface modules shall communicate supervised wiring status (normal, trouble) to fire alarm control panel and shall receive from fire alarm control panel a command to transfer relay.

Interface Modules - Supervised Monitoring:

a. Addressable Interface Modules shall be suited for monitoring of water-flow, valve tamper, Halon Control Panels, non-intelligent detectors.
b. An addressable interface module shall be provided for interfacing normally open direct-contact devices to an intelligent initiating circuit as follows:
    i. For conventional 2-wire smoke detector and/or contact device monitoring with class B or class A wiring supervision.
    ii. This interface module shall provide power to and monitor status of a zone consisting of conventional 2-wire smoke detectors and/or N/O contact devices as specified elsewhere and shown on drawings.
    iii. Supervision of zone wiring shall be Class B or Class A.
    iv. These interface modules shall communicate zone's status (normal, alarm, trouble) to control panel.
    v. For conventional 4-wire smoke detector with Class B wiring supervision.
    vi. This interface module shall provide power to and monitor contact status of a zone consisting of conventional 4-wire smoke detectors as specified elsewhere.
    vii. Interface module shall provide detector reset capability and a 2 amp fuse to provide over-current power protection for 4-wire detector.
    viii. These interface modules shall communicate zone's status (normal, alarm, trouble) to control panel.

Interface Modules - Non-Supervised Control:

a. 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 relay.

B.6 Fault Isolator Module

System shall Fault Isolator Module (FIM) on initiating device circuits in following situations:

a. Loop extends to another floor.
b. Loop extends to another building.
c. Loop has more than 25 devices.

ILCP shall be located as close as practical to point where these conditions occur.

FIM shall automatically re-connect isolated section of loop upon correction of fault conditions. FIM shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an FIM after its normal operation.

FIM shall include an LED which shall flash under normal operation and illuminate steady to indicate a short circuit.

B.7 Conventional Peripheral Devices

Horn/Strobe Units

a. Alarm horns shall be polarized and operate on 24 VDC circuit provided by control panel.
b. Each horn assembly shall include separate wire leads for in/out wiring for each leg of associated signal circuit.
c. T tapping of signal device conductors to signal circuit conductors shall NOT be accepted.
d. Alarm horns shall be suitable for rear mounting behind audio-visual assemblies which shall be flush or semi-flush mounted, wherever possible, with manufacturer backboxes and flush trim ring.
e. White Lexan lens shall have word "FIRE" in red lettering on sides.
f. Strobes installed in open areas such as hallways, open office spaces, and assembly areas shall provide 15/75 candela peak power and 110 candela peak power where installed in sleeping areas, bathrooms, and mechanical areas.
g. All strobes shall be in compliance with ADA requirements and be on a separate supervised circuit from horn circuit.
h. Strobes shall be synchronized so all strobes units within sight flash simultaneously.
i. Horns shall be UL listed to provide a minimum sound pressure level of 96 dB at 10 feet.

B.8 Special Devices

Smoke Detector Guards

a. Provide and install a protective guard for each smoke detector installed in **UTILITY ROOMS.**
    i. Guards shall be made of 14 gauge meshed steel.
    ii. Mesh size shall be 3/16" in diameter, (16-holes/sq. inch).

iii. Guards shall include brackets and Pinned “torx” head type tamper proof screws for either ceiling or wall mounting.
iv. Wall-mounted guard shall have a 45-degree top slant to prevent its use for supporting purposes.

Tools And Keys

a. Contractor shall provide to owner **3** tools for insertion and removal of Pinned “torx” head type tamper proof screws.
b. Contractor shall provide two (2) keys per pull station.
c. Keys shall be identical and usable in all keyways associated with this project.
d. If required, smoke detector programming devices shall also be provided.

B.9 Wire and Cable

Manufacturers:

a. Belden or equal.
b. Substitutions: In accordance to Section 26 00 00 - Basic Electrical Requirements - Product Requirements.

Product Description: Non-power limited fire-protective signaling cable, copper conductor, 150 volt insulation rated 60 degrees C.

Plenum Cable: Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

C Construction

C.1 Examination

Section 26 00 00 - Administrative Requirements: Coordination and project conditions.

Verify products and systems receiving devices are ready for installation.

C.2 General

Complete installation shall be done in a neat, workmanlike manner in accordance to applicable requirements of NFPA 70 - Article 760 and manufacturer's specifications and written requirements.

In a dusty environment such as new construction, smoke detectors shall not be mounted until construction is completed.

Class B circuiting shall be used.

C.3 Raceways

All wiring shall be in a conduit system separate from other building wiring. See Section 26 05 33 – Raceways and Boxes for specifications.

All wiring shall be in minimum 3/4 inch steel raceway.

Contractor shall size conduit and boxes by circular mil size of each cable in each conduit or box.

Circular mil sizing can be found on manufacture's spec sheet, then use 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.

C.4 Conductors

Fire alarm circuit conductors have insulation color or code as follows:

a. Power Branch Circuit Conductors: Black, red, white.
b. Initiating Device Circuit: Black, red.
c. Detector Power Supply: Violet, brown.
d. Signal Device Circuit: Blue (positive), white (negative).
e. Door Release: Gray, gray.
f. Municipal Trip Circuit: Orange, orange.
g. Municipal Fire Alarm Loop: Black, white.

All cable shall be installed as per NEC Article 760.

All cables and wires shall be No. 14 AWG and larger shall be stranded.

All wiring shall be completely supervised. In event of a primary power failure, disconnected standby battery, disarrangement of any components, any open circuits or grounds in system, an audible and visual trouble signal shall be activated until system is restored to normal.

All conductors shall be color-coded. Coding shall be consistent throughout facility. Green wire shall be used only for equipment ground.

Fire Alarm Control Panel shall be connected to separate dedicated branch circuit from building emergency panel, maximum 20 amperes. Circuit shall be labeled as "FIRE ALARM".

Power wiring for Fire Alarm Control Panel shall be No. 12 AWG.

Fire Alarm Control Panel shall have No. 12 AWG green equipment ground wire.

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 Fire Alarm Control Panel and Remote Annunciator Panel(s).

Cable for Intelligent Detector Loops shall be No. 18 to No. 12 AWG twisted pair with a shield jacket installed in 3/4 inch conduit. Shield continuity must be maintained and connected to earth ground only at control panel. Intelligent detector wiring must not be in same conduit with 120/240 VAC power wiring or other high current circuits. T-taps or branch circuit connections are allowed for all class B intelligent loop circuits.

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 data signal. Power wiring shall be No. 12, or No. 14 AWG.

Wiring of alarm horn circuits and alarm strobe circuits shall be No. 14 AWG minimum.

Fire alarm cables shall be held in place at device box, by means of a two-screw connector, (do not use squeeze or crimp type connectors).

All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and/or labeled "FIRE ALARM SYSTEM" by decal or other approved markings.

Horn and strobe circuits shall have separate conductors, and shall operate independently of each other.

Horn and strobe wiring shall be No. 14 AWG minimum or as recommend by manufacturer.

Tray cable is not acceptable for use as fire alarm systems wiring.

C.5 Device Mounting

Unless otherwise noted on drawings, specifications or identified by architect or engineer; recommended mounting heights and requirements are as follows:

a. Fire Alarm Control Panels
    i. Mount control panels so all visual indicators and controls at 60 inches above floor level.
    ii. Install 120-volt AC wiring with green ground wire on a dedicated separate circuit, maximum 20 amperes.
    iii. Use only identified conduit entries or request approval for other penetrations in cabinets; (certain areas require clear space for interior components).
    iv. Cabinet shall be grounded to either a cold water pipe or grounding rod.
b. Remote Annunciators
    i. Mount panels so all visual indicators and controls at 60 inches above floor level.
    ii. Install multi-gang box as required by manufacturer, flush or surface mounted.

iii. Install wiring conductors in conduit, No. 16 AWG minimum or twisted shielded pairs, to Control Panel quantity as required.

c. Audio-Visual Devices
   i. Install flush, semi-flush or surface mount at 6 inches below finished ceiling or at 80 inches from bottom of device to highest level of finished floor.
   ii. No devices protruding 4 inches or more shall be installed lower than 80 inches.
   iii. Audio/Visual devices may be installed on ceilings in accordance to 1996 NFPA Table 6-4.4.1(b).
   iv. If these requirements are not achievable, consult with engineer before installation.
   v. All audio/visual devices shall be installed at same height throughout facility.
   vi. For surface mounting, use manufacture-supplied backboxes and trim plates. Mark each device with circuit number.

d. Manual Stations
   i. Operable part of manual stations shall be installed not less than 3 1/2 feet (42 inches) and not more than 4 1/2 feet (54 inches) above finished floor.
   ii. All Manual Stations shall be in unobstructed locations.
   iii. Mark unit's address on inside and outside of housing.
   iv. For surface mounting, use manufacture-supplied backboxes and trim plates.

e. Heat And Smoke Detectors
   i. Location of detectors shown on drawings is schematic only.
   ii. Detectors must be located according to code requirements.
   iii. Surface mounted detectors shall be installed using back boxes equal to base's size.
   iv. Standard octagon and square boxes are not acceptable.
   v. Detectors should be located on highest part of a smooth ceiling so that edge of detector is no closer than 4 inches from a sidewall.
   vi. Ceilings with beams, joists or soffits that exceed 8 inches in depth require special planning and closer spacing. Verify with manufacturer.
   vii. If it is necessary to mount a detector upon a sidewall, top of detector shall be located no closer than 4 inches from ceiling and no further away than 12 inches.
   viii. 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 detector. No detectors shall be installed in direct airflow.
   ix. Ideally, heat and smoke detectors should be located near center of open area which they are protecting, thus providing coverage generally for 15 foot radius for smoke detectors and a 25 foot radius for heat detectors. Verify location with architect/ engineer.
   x. Mark address and loop number on each detector's base.

C.6 Identification
All junction boxes shall be painted red and labeled "Fire Alarm".

All circuits must be labeled with name of circuit and area being served by circuit.

All labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED.

Label size shall be appropriate for conductor or cable size(s) and design.

All labels to be used shall be self-laminating, white/transparent vinyl and be wrapped around cable. Flag type labels are not allowed.

Labels shall be of adequate size to accommodate circumference of cable being labeled and properly self-laminate over full extent of printed area of label.

Adhesive type labels not permitted except for phase and wire identification.
Wiring color code shall be maintained throughout installation. Green wire shall be used only for equipment ground.

C.7 Manufacturer’s Services
Following supervision of installation shall be provided by a trained service technician from manufacturer of fire alarm equipment.

This Technician shall be US certified and have had a minimum of two years of service experience in fire alarm industry.

Technician's name shall appear on equipment submittals and a letter of certification from fire alarm manufacturer shall be sent to engineer.

Manufacturer's service technician shall be responsible for following items:

a. Pre-installation visit to job site to review equipment submittals and verify method by which system should be wired.
b. During job progress make periodic job site visits to verify installation and wiring of system.
c. Upon completion of wiring, final connections shall be made under supervision of this technician, and final checkout and certification of system.
d. At time of final checkout, technician shall give operational instructions to owner and his representative on system.

All job site visits shall be dated and documented in writing and signed by electrical contractor.

Any discrepancy shall be noted on this document and a copy kept in system job folder, which shall be available to engineer any time during project.

C.8 Testing

Manufacturer's authorized representative shall provide on-site supervision of installation of complete fire alarm system installation, perform a complete functional test of each system, and submit a written report to contractor attesting to proper operation of completed system prior to final inspection.

Contractor shall test each and every device in system before system is considered substantially complete.

Completed fire alarm system shall be fully tested in accordance to NFPA-72 by contractor in presence of owner's representative and local Fire Marshal.

Upon completion of a successful test, and prior to final request for payment contractor shall:

a. Certify system to owner in writing.
b. Complete NFPA 1-7.2.1 record of completion form.
c. Provide as builts and OandM manuals.

Final payment will not be processed unless these documents are on hand and complete.

C.9 Warranty

Warrant completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of 2 years from date of substantial completion of project.

At end of project, contractor shall post warranty period along with company’s name and telephone number inside 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 notification, to contractor, of failure of system to perform operationally per UL and NFPA standards.

Non-emergency service calls shall be responded to within 24 hours of notification to contractor.

Repairs and/or replacement shall be completed within 72 hours of time of notification.

Other than emergency, actual repairs and replacement shall be provided during normal working hours, Monday through Friday, excluding holidays.

If repair and replacement cannot be made within prescribed time, then other means and methods of protection shall be provided to ensure safety of building occupants during which time system is not in compliance with standards.

This may involve up to and include hiring owner approved qualified personnel to stand a fire watch, all at contractor's expense.

Warranty service for equipment shall be provided by system supplier's factory trained representative. Further, warranty shall include all parts, labor and necessary travel.

C.10 Training
Contractor through their supplier shall provide, as part of this contract, a minimum of 8 hours system operation training for owner, architect/engineer, and fire department personnel.

Training sessions shall be at a time to be stipulated by owner.

All training and other indoctrinations shall be completed prior to final inspection.

C.11 Maintenance Contract
Equipment manufacturer shall make available to owner a maintenance contract proposal to provide a minimum of two inspections and tests per year in compliance with NFPA-72 Codes.

C.12 Special Considerations
Contractor shall notify owner's security officer 24 hours in advance of any zones inoperative for a period of time exceeding 2 hours.

102. Temporary Shoring, Item SPV.0105.40.

A Description
This special provision describes furnishing and installing temporary shoring at locations alongside railroad tracks as shown in the plan and in accordance to the shoring design requirements.

B Materials
Provide a shoring design for each location where the contractor’s staging plan requires temporary shoring. Have a professional engineer, registered in the State of Wisconsin and knowledgeable of the specific site conditions and requirements verify the adequacy of the design. Submit one copy of each shoring design, signed and sealed by the same professional engineer verifying the design, to the engineer for incorporation into the permanent project record.

Refer to standard spec 107.17(5) and (6) regarding the development and submittal of shop drawings, detailed plans, and computations for temporary construction near the Canadian Pacific Railroad’s tracks. Include in the submitted drawings and plans the proposed method of installation and removal of the shoring not included in the contract plans.

C Construction

The Canadian Pacific Railroad (CP) will coordinate train operations with the contractor to the extent possible, consistent with its operational requirements. The number and duration of work windows free of train operations available per day will vary depending on operational requirements. At the end of each window, leave the construction area in a condition that will allow for safe and normal train operations. Do not leave shoring extended above the top of rail within 12'-0" from the centerline of the nearest track. Contact Jim Krieger,Canadian Pacific Railroad, 501 Marquette Avenue, Room 635, Box 530-55440, Minneapolis, MN 55402, telephone (612) 904-5991 at least three working days in advance of construction operations that require implementation of the temporary shoring.

Provide, install and maintain adequate protection for people within the Canadian Pacific Railroad's right-of-way. Cover, guard, and/or protect all excavations, holes, or trenches within the CP's right-of-way when they are not being worked on. When leaving work site areas at night and over weekends, secure the areas and leave them in a condition that will ensure that railroad employees and other personnel, who may be working or passing through the area, are protected around excavations. Install handrails that are parallel to the track and not less than 9'-0" from the centerline of the nearest track. Handrails, fences, or other barrier methods must meet OSHA and FRA requirements. Backfill all excavations as soon as possible.

Remove shoring after it is no longer needed. Backfill any voids with flowable granular backfill.

D Measurement

The department will measure Temporary Shoring 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.0105.40	Temporary Shoring	LS

Payment is full compensation for providing a verified design of the shoring; providing shop drawings and detailed plans; furnishing and hauling materials to each location; installing the shoring; maintaining the shoring as needed; removing the shoring; backfilling upon completion of the need for the shoring; and for furnishing all labor, tools, equipment, materials, and incidentals needed to complete the contract work. Payment includes all shoring shown in the drawings, additional shoring installed based on the contractor's approved staging plan, and shoring installed for the convenience of the contractor's operations.

103. Piling Steel Delivered, Driven and Tested, Item SPV.0105.41.

A Description

This special provision describes the fabrication, furnishing, installation and testing of concrete filled steel piles as shown on the architectural and structural drawings, inferable there from and specified herein.

B Materials

Piles: ASTM A252 Grade 2, minimum 35 ksi yield strength, sizes and lengths as required to achieve design loads.

Concrete Fill: 4 ksi, self-consolidating mix, see Concrete Section for additional information.

C Construction

C.1 Installation

Use driving method which will not cause damage to nearby structures.

Notify adjacent and affected land owners and building occupants before proceeding with the work.

Protect structures including overhead and buried utilities near the work, from damage.

Prepare to place piles from existing site elevations.

Use pile hammer complying with requirements indicated on Drawings.

Keep hammer in good mechanical condition.

Operate hammer at speed and pressure recommended by manufacturer.

When energy per blow is less than 80 percent of rated energy per blow as specified by manufacturer of pile hammer, make necessary repairs to improve energy output to value of at least 80 percent of rated energy per blow, or replace pile hammer.

Use rigid frame, fixed lead type driving equipment capable of supporting pile firmly in vertical position or to required batter.

Align top of pile normal to driving force of pile, hammer and leads to minimize bowing of pile during impact of hammer ram.

Where groups of piles are required, drive center pile of group first and then drive remaining piles in group progressing outward from center.

Drive piles to minimum tip penetration and to driving resistance indicated on Drawings. Take corrective action, when required to prevent observable impact bowing of pile at final driving resistance.

When driving resistance prohibits advancing pile to required minimum tip penetration, spud, jet, jet and drive, or use other means as necessary to advance pile to required minimum tip penetration. Then drive pile to required resistance indicated on Drawings. After jetting pile, re-drive adjacent piles to required resistance.

Pre-drilling or pre-augering of maximum diameter 2 inches smaller than pile outside diameter may be used to advance pile to penetration no deeper than required minimum tip penetration. Then drive pile to required resistance indicated on Drawings.

Protect pile head during driving, using cap-block cushion consisting of alternate plates of phenolic laminate and aluminum designed to prevent damage to piles while transmitting required hammer energy to pile top as indicated on Drawings, with full bearing on pile butt for even distribution of hammer blow.

Deliver hammer blows to central axis of pile.

When driving is interrupted before refusal, drive an additional 12 inches before resuming recording of performance data.

Re-drive piles which have lifted due to driving adjacent piles, or by soil uplift.

Do not damage piles during driving operations.

Cut off tops of piles to elevations indicated and prepare pile top to receive pile caps.

Perform welding in accordance to AWS D1.1 for shielded metal arc welding.

Only use welders qualified in accordance to AWS D1.1.

Reinforce pile tips, as indicated on Drawings.

Splice pile sections with one of the following:

a. Complete penetration butt weld of wall.
b. Splicer sleeve with wall welded with full penetration groove welds.

Use jig or alignment device during welding to maintain required specified.

For splices made during pile installation, rigid frame pile leads may be used as jig.

Use only butt weld splices within 20 feet from pile cut-off elevation or design grade, whichever is lower.

Comply with the following for number, type and location of splices:

a. No more than three splices for piles over 100 feet long.
b. No more than two splices for piles up to 100 feet long.
c. No splice closer than 25 feet from tip.

Maximum Variation from Vertical for Plumb Piles: 1 in 48

Maxim Variation from Pile Cut-Off Elevation: 4 inches

Maximum Out-of-Position: 2 inches

Maximum Variation in Centerline after Splicing: 3/8 inches in 40 feet for undriven portion

C.3 Testing

Perform work in accordance to ASTM D1143 and ASTM D3689.

Monitor test pile placement and elevations under direct supervision of a professional engineer experienced in design of this work and licensed in State of Wisconsin.

Sequence work to allow other piling and work during testing.

Equipment Type, Load Carrying Device, Load, and Instrumentation: Conform to ASTM D1143 and ASTM D3689 of same type as will be used for pile placement of the work.

Test Crib: Provide one test crib for pile load testing.

Verify site conditions will support cribbing and load for testing purposes.

Establish stable working elevation for test equipment.

Subject piles to two times design load.

Acceptable Permanent Settlement of Piles after Load Testing: ¼ inches.

If tested piles do not conform to requirements, perform additional testing of other piles.

An independent inspection firm will be engaged to observe and document test method and results. Notify inspection firm 48-hours prior to initiating any test.

Document test equipment used, method of calibration and recording, test results, and recommendations or modification of piling method used.

Accurately record actual dimensions and locations of tested piles and movement of distortion caused by testing.

Remove test and temporary load equipment from site.

Test piles to be same diameter and type as specified for other piling, placed in same manner.

Accepted test piles may be used in the work.

Test 1 indicator piles.

Unacceptable Piles: Piles that fail tests, are placed out of position, are below cut-off elevations, or are damaged.

C.4 Submittals
Submit test procedure: Indicate test method and equipment, load type, and calibration equipment, for review.

Shop Drawings: Indicate details and schedule of pile installation sequence. Identify recommended pile length and shapes to suit design loads.

Product Data: Submit details of collars, tips, splices, and cushion blocks.

Manufacturer's Mill Certificate: Certify steel casing meets or exceeds specified requirements.

D Measurement
The department will measure Piling Steel Delivered, Driven, and Tested as a single lump sum unit of work for piling steel delivered, driven, and tested, 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.0105.41	Piling Steel Delivered, Driven, and Tested	LS

Payment is full compensation as per the plans, details, schedules, and these special provisions; and all labor tools, equipment, and incidentals necessary to complete the contract work. Concrete for piles to be included as part of this Special Provision.

104. Concrete Structures, Item SPV.0105.42.

A Description
A.1 General
This special provision specifies cast-in place concrete, including formwork, concrete materials, mix design, placement procedures, and finishes, describes proportioning, mixing, placing, and protecting concrete mixtures.

A.2 Submittals

a. Product Data: For each type of manufactured material and product indicated.
b. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
    i. Indicate amounts of mix water to be withheld for later addition at project site.
c. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
d. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are contractor's responsibility.
    i. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
e. Welding Certificates: Copies of certificates for welding procedures and personnel.
f. 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:
g. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
    i. Cementitious materials and aggregates.
    ii. Form materials and form-release agents.
    iii. Steel reinforcement and reinforcement accessories.
    iv. Admixtures.
    v. Waterstops.
    vi. Curing Materials.
    vii. Floor and slab treatments.
    viii. Bonding agents.
    ix. Adhesives.
    x. Vapor Retarders.
    xi. Epoxy joint filler.
    xii. Joint-filler strips.
    xiii. Repair materials.
h. Minutes of preinstallation conference.

A.3 Quality Assurance

A.3.1 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 a record of successful in-service performance.

A.3.2 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 formwork and shoring and reshoring installations that are similar to those indicated for this project in material, design, and extent.

A.3.3 Manufacturer Qualifications
A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

A.3.4 Testing Agency Qualifications
An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

A.3.5 Source Limitations
Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

A.3.6 Welding
Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

A.3.7 ACI Publications
Comply with the following, unless more stringent provisions are indicated:
ACI 301, “Specification for Structural Concrete.”
ACI 117, “Specification for Tolerances for Concrete Construction and Materials.”

A.3.8 Mockups
Cast concrete slabs-on-grade mockup to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

Build mockups approximately 200 sq. feet (18.6 sq. m) in the location indicated or, if not indicated, as directed by engineer.

Notify engineer seven days in advance of dates and times when mockups will be constructed.

Obtain engineer's approval of mockups before starting construction.

If engineer determines that mockups do not meet requirements, demolish and remove them from the site and cast another until the mockup is approved.

Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.

Demolish and remove mockups when directed.

Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

A.3.9 Preinstallation Conference
Conduct conference at project site to comply with requirements in Division 1 section "Project Meetings."

Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor’s superintendent.
b. Independent testing agency responsible for concrete design mixes.
c. Ready-mix concrete producer.
d. Concrete subcontractor.

A.4 Delivery, Storage, and Handling
Deliver, store, and handle steel reinforcement to prevent bending and damage.

Avoid damaging coatings on steel reinforcement.

Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963/ D 3963M.

B Materials
B.1 Form-Facing Materials
B.1.1 Smooth-Formed Finished Concrete
Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

Plywood, metal, or other approved panel materials.

Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1, or better.
b. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
c. Structural 1, B-B, or better, mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.

B.1.2 Rough-Formed Finished Concrete
Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

B.1.3 Forms for Cylindrical Columns, Pedestals, and Supports
Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

B.1.4 Chamfer Strips
Wood, metal, PVC, or rubber strips, ¾ by ¾ inch (19 by 19 mm), minimum.

B.1.5 Form-Release Agent
Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

Formulate form-release agent with rust inhibitor for steel form-facing materials.

B.1.6 Form Ties
Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.

Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.

Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

B.1.7 Concrete Materials
B.1.7.1 Portland Cement
Comply with ASTM C 150, Type I.

B.1.7.2 Blended Hydraulic Cement
Comply with ASTM C 595M, Type IS, Portland blast-furnace slag cement.

B.1.7.3 Silica Fume
Comply with ASTM C 1240, amorphous silica.

B.1.7.4 Normal-Weight Aggregate
Comply with ASTM C 33, uniformly graded, and as follows:

a. Class: Moderate weathering region, but not less than 3M.
b. Nominal Maximum Aggregate Size: 1-1/2 inches (38 mm).
c. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).
d. Lightweight Aggregate: ASTM C 330.
e. Nominal Maximum Aggregate Size: 3/4 inch (19 mm).

B.1.7.5 Water
Potable and complying with ASTM C 94.

B.2 Admixtures
B.2.1 General
Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B.2.2 Air-Entraining Admixture
Comply with ASTM C 260.

B.2.3 Water-Reducing Admixture
Comply with ASTM C 494, Type A.

B.2.4 High-Range, Water-Reducing Admixture
Comply with ASTM C 494, Type F.

B.2.5 Water-Reducing and Accelerating Admixture
Comply with ASTM C 494, Type E.

B.2.6 Corrosion-Inhibiting Admixture
Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

B.2.7 Available Products
Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:

B.2.7.1 Products
Subject to compliance with requirements, provide one of the following:
a. Catexol 1000CL; Axim Concrete Technologies.
b. MCI 2000 or MCI 2005; Cortec Corporation.
c. DCI or DCI-S; W. R. Grace & Co., Construction Products Div.
d. Rheocrete 222+; Master Builders, Inc.
e. FerroGard-901; Sika Corporation.
f. Approved equal

B.3 Waterstops
B.3.1 Flexible Rubber Waterstops
CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

B.3.2 Profiles
Flat, dumbbell with center bulb.
Flat, dumbbell without center bulb.
Ribbed with center bulb.
Ribbed without center bulb.
As indicated.

B.3.3 Available Manufacturers
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

B.3.3.1 Manufacturers
Subject to compliance with requirements, provide products by one of the following:
a. Rubber Waterstops:
b. Greenstreak
c. Progress Unlimited Inc.
d. Westec Barrier Technologies; Div. of Western Textile Products, Inc.
e. Williams Products, Inc.

B.3.4 Self-Expanding Strip Waterstops
Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

B.3.5 Available Products
Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:

B.3.6 Products
Subject to compliance with requirements, provide one of the following:
a. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
b. Conseal CS-231; Concrete Sealants Inc.
c. Swellseal Joint; De Neef Construction Chemicals (U.S.) Inc.

d. Hydrotite; Greenstreak.
e. Mirastop; Mirafi Moisture Protection, Div. of Royal Ten Cate (USA), Inc.
f. Adeka Ultra Seal; Mitsubishi International Corporation.
g. Superstop; Progress Unlimited Inc.
h. Approved equal.

B.4 Vapor Retarders

B.4.1 Vapor Retarder

Comply with ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick:

a. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils (0.25 mm) thick.
b. Three-ply, nylon- or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 7.8 mils (0.18 mm) thick.

B.4.2 Fine-Graded Granular Material

Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 (4.75-mm) sieve and 10 to 30 percent passing a No. 100 (0.15-mm) sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

B.5 Curing Materials

B.5.1 Evaporation Retarder

Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B.5.2 Absorptive Cover

Comply with AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B.5.3 Moisture-Retaining Cover

Comply with ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B.5.4 Water

Potable.

B.5.5 Clear, Solvent-Borne, Membrane-Forming Curing Compound

Comply with ASTM C 309, Type 1, Class B.

B.5.6 Available Products

Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:

B.5.7 Products

Subject to compliance with requirements, provide one of the following:

a. Evaporation Retarder:
   i. Cimfilm; Axim Concrete Technologies.
   ii. Finishing Aid Concentrate; Burke Group, LLC (The).
   iii. Spray-Film; ChemMasters.
   iv. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
   v. Sure Film; Dayton Superior Corporation.
   vi. Eucobar; Euclid Chemical Co.
   vii. Vapor Aid; Kaufman Products, Inc.
   viii. Lambco Skin; Lambert Corporation.
   ix. E-Con; L&M Construction Chemicals, Inc.
   x. Confilm; Master Builders, Inc.
   xi. Waterhold; Metalcrete Industries.
   xii. Rich Film; Richmond Screw Anchor Co.
   xiii. SikaFilm; Sika Corporation.
   xiv. Finishing Aid; Symons Corporation.
   xv. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.
   xvi. Approved equal.
b. Clear, Solvent-Borne, Membrane-Forming Curing Compound:
   i. AH Clear Cure; Anti-Hydro International, Inc.
   ii. Spartan-Cote; Burke Group, LLC (The).
   iii. Spray-Cure & Seal 15; ChemMasters.
   iv. Conspec #1-15 percent solids; Conspec Marketing & Manufacturing Co., Inc.
   v. Day-Chem Cure and Seal; Dayton Superior Corporation.
   vi. Diamond Clear; Euclid Chemical Co.
   vii. Nitocure S; Fosroc.
   viii. Cure & Seal 309; Kaufman Products Inc.
   ix. Lambco 120; Lambert Corporation.
   x. L&M Dress & Seal 18; L&M Construction Chemicals, Inc.
   xi. CS-309; W. R. Meadows, Inc.
   xii. Seal N Kure; Metalcrete Industries.
   xiii. Rich Seal 14 percent UV; Richmond Screw Anchor Co.
   xiv. Kure-N-Seal; Sonneborn, Div. of ChemRex, Inc.
   xv. Flortec 14; Sternson Group.
   xvi. Cure and Seal 14 percent; Symons Corporation.
   xvii. Clear Seal 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
   xviii. Acrylic Cure; Unitex.
   xix. Certi-Vex AC 309; Vexcon Chemicals, Inc
   xx. Approved equal.
c. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound:
   i. Spray-Cure and Seal Plus; ChemMasters.
   ii. UV Super Seal; Lambert Corporation.
   iii. Lumiseal Plus; L&M Construction Chemicals, Inc.

iv. CS-309/30; W. R. Meadows, Inc.
v. Seal N Kure 30; Metalcrete Industries.
vi. Rich Seal 31 percent UV; Richmond Screw Anchor Co.
vii. Cure and Seal 31 percent UV; Symons Corporation.
viii. Certi-Vex AC 1315; Vexcon Chemicals, Inc.
ix. Approved equal.

B.6 Related Materials

B.6.1 Joint-Filler Strips

Comply with ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

B.6.2 Epoxy Joint Filler

Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

B.6.3 Bonding Agent

Comply with ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B.6.4 Epoxy-Bonding Adhesive

Comply with ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

a. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
b. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
c. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

B.6.5 Reglets

Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B.6.6 Dovetail Anchor Slots

Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

B.7 Repair Materials

B.7.1 Repair Underlayment

Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

B.7.1.1 Cement Binder
Comply with ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

B.7.1.2 Primer
Product of underlayment manufacturer recommended for substrate, conditions, and application.

B.7.1.3 Aggregate
Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.

B.7.1.4 Compressive Strength
Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B.7.2 Repair Topping
Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).

B.7.2.1 Cement Binder
Comply with ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

B.7.2.2 Primer
Product of topping manufacturer recommended for substrate, conditions, and application.

B.7.2.3 Aggregate
Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.

B.7.2.4 Compressive Strength
Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B.8 Concrete Mixes
Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

a. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
b. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
c. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

B.8.1 Footings and Foundation Walls
Proportion normal-weight concrete mix as follows:

a. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
b. Maximum Slump: 4 inches (100 mm).
c. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.

B.8.2 Slab-on-Grade
Proportion normal-weight concrete mix as follows:

a. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
b. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m).
c. Maximum Slump: 4 inches (100 mm).

B.8.3 Suspended Slabs
Proportion normal-weight concrete mix as follows:

a. Compression Strength (28 Days): 4000 psi (27.6 MPa).
b. Maximum Slump: 4 inches (100 mm).

B.8.4 Cementitious Materials
For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.

B.8.5 Cementitious Materials
Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

a. Fly Ash: 25 percent.
b. Combined Fly Ash and Pozzolan: 25 percent.
c. Ground Granulated Blast-Furnace Slag: 50 percent.
d. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
e. Silica Fume: 10 percent.
f. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
g. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent portland cement minimum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

B.8.6 Maximum Water-Cementitious Materials Ratio
0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.

B.8.7 Air Content
Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.

Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

B.8.8 Steel-Fiber Reinforcement
Add to concrete mix, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (29.7 kg/cu. m).

B.8.9 Admixtures
Use admixtures according to manufacturer's written instructions.Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B.9 Concrete Mixing
B.9.1 Ready-Mixed Concrete
Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

B.10 Rubberized Membrane Waterproofing
Select the rubberized membrane, primer, and mastic from the department's approved products list. Use membrane at least 60 mil thick.

C Construction
C.1 Formwork
Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

a. Class A, 1/8 inch (3 mm).
b. Class B, 1/4 inch (6 mm).
c. Class C, 1/2 inch (13 mm).
d. Class D, 1 inch (25 mm).

Construct forms tight enough to prevent loss of concrete mortar.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.

Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

Do not use rust-stained steel form-facing material.

Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

Chamfer exterior corners and edges of permanently exposed concrete.

Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the work. Determine sizes and locations from trades providing such items.

Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

C.2 Embedded Items

Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts, accurately located, to elevations required.

Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

Install dovetail anchor slots in concrete structures as indicated.

C.3 Removing and Reusing Forms

C.3.1 General

Formwork, for sides of beams, walls, columns, and similar parts of the work, that does not support weight of concrete may be removed after cumulatively curing at not less than

50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

28-day design compressive strength.

Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by engineer.

C.4 Shores and Reshores

Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

C.5 Vapor Retarders

Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

Fine-Graded Granular Material: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

Granular Fill: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.

C.6 Joints

C.6.1 General

Construct joints true to line with faces perpendicular to surface plane of concrete.

C.6.2 Construction Joints

Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by engineer.

Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C.6.3 Contraction Joints in Slabs-on-Grade

Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
c. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 section "Joint Sealants," are indicated.

Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

C.6.4 Dowel Joints
Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C.7 Waterstops
Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

C.7.2 Self-Expanding Strip Waterstops
Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

C.8 Concrete Placement
Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

Do not add water to concrete during delivery, at project site, or during placement, unless approved by engineer.

Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to

consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Maintain reinforcement in position on chairs during concrete placement.

Screed slab surfaces with a straightedge and strike off to correct elevations.

Slope surfaces uniformly to drains where required.

Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

C.8.1 Cold-Weather Placement

Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

C.8.2 Hot-weather Placement

Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

a. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is contractor's option.
b. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
c. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

C.9 Finished Formed Surfaces

C.9.1 Rough-Formed Finish

As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

C.9.2 Smooth-Formed Finish

As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.

Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

Do not apply rubbed finish to smooth-formed finish.

C.9.3 Related Unformed Surfaces

At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

C.10 Flooring Floors and Slabs

C.10.1 General

Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

C.10.2 Scratch Finish

While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

C.10.3 Float Finish

Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C.10.4 Trowel Finish
After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15.
b. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.

Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot- (3.05-m-) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:

a. 1/4 inch (6.4 mm).
b. 3/16 inch (4.8 mm).
c. 1/8 inch (3.2 mm).

C.10.5 Trowel and Fine-Broom Finish
Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

C.10.6 Broom Finish
Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with engineer before application.

C.10.7 Slip-Resistive Aggregate Finish
Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

a. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
b. After broadcasting and tamping, apply float finish.
c. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

C.10.8 Mineral Dry-Shake Floor Hardener Finish

After initial floating, apply mineral dry-shake materials to surfaces according to manufacturer's written instructions and as follows:

a. Uniformly apply mineral dry-shake materials at a rate of 100 lb/100 sq. feet (49 kg/10 sq. m), unless greater amount is recommended by manufacturer.
b. Uniformly distribute approximately two-thirds of mineral dry-shake materials over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second mineral dry-shake application, uniformly distributing remainder of material, and embed by power floating.
c. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake material manufacturer and apply immediately after final finishing.

C.11 Miscellaneous Concrete Items

C.11.1 Filling In

Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete work.

C.11.2 Curbs

Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C.11.3 Equipment Bases and Foundations

Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

C.11.4 Steel Pan Stairs

Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

C.12 Concrete Protection and Curing

C.12.1 General

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

C.12.2 Evaporation Retarder

Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C.12.3 Formed Surfaces

Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

C.12.4 Uniformed Surfaces

Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

C.12.4.1 Moisture Curing

Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

C.12.4.2 Moisture-Retaining-Cover Curing

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

C.12.5 Curing Compound
Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

C.12.6 Curing and Sealing Compound
Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

C.13 Liquid Floor Treatments
C.13.1 Penetrating Liquid Floor Treatment
Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

Do not apply to concrete that is less than seven days old.

Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

C.13.2 Sealing Coat
Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

C.14 Joint Filling
Prepare, clean, and install joint filler according to manufacturer's written instructions.

Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

Install semi-rigid epoxy joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

C.15 Concrete Surface Repairs

C.15.1 Defective Concrete

Repair and patch defective areas when approved by engineer. Remove and replace concrete that cannot be repaired and patched to engineer's approval.

C.15.2 Patching Mortar

Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.

C.15.3 Repairing Formed Surfaces

Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by engineer.

C.15.4 Repairing Unformed Surfaces

Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

After concrete has cured at least 14 days, correct high areas by grinding.

Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

Perform structural repairs of concrete, subject to engineer's approval, using epoxy adhesive and patching mortar.

Repair materials and installation not specified above may be used, subject to engineer's approval.

C.16 Field Quality Control

C.16.1 Testing Agency

Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

C.16.2 Testing Services

Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

a. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

b. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
c. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
d. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
e. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
f. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
g. Cast and field cure one set of four standard cylinder specimens for each composite sample.
h. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
i. Test two field-cured specimens at 7 days and two at 28 days.
j. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
k. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
l. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
m. Test results shall be reported in writing to engineer, concrete manufacturer, and contractor within 48 hours of testing. Reports of compressive-strength tests shall contain project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

C.16.3 Nondestructive Testing

Impact hammer, sonoscope, or other nondestructive device may be permitted by engineer but will not be used as sole basis for approval or rejection of concrete.

C.16.4 Additional Tests

Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by engineer.

C.17 Rubberized Membrane Waterproofing
Construct membrane watproofing according to requirements in standard spec 516.3.

D Measurement
The department will measure Concrete Structures as a single lump sum unit of work for concrete structures, 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.0105.42	Concrete Structures	LS

Payment is full compensation for furnishing all concrete work as per the plans, details, schedules, and these special provisions; for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work; and for providing and installing name plates.

105. Bar Steel Reinforcement, Structures, Item SPV.0105.43.

A Description
A.1 General
This special provision specifies the reinforcement in cast-in-place concrete.

A.2 Submittals
A.2.1 Steel Reinforcement Shop Drawings
Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

B Materials
B.1 Steel Reinforcement
B.1.1 Reinforcing Bars
Comply with ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B.1.2 Epoxy-Coated Fabricated Reinforcing Bars
Comply with ASTM A 934/A 934M, and as follows:

a. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
b. Steel bar Mats: ASTM A 184/A 184M, assembled with clips.
c. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B.1.3 Plain-Steel Wire
Comply with ASTM A 82, as drawn.

B.1.4 Deformed-Steel Wire
Comply with ASTM A 496.

B.1.5 Plain-Steel Welded Wire Fabric
Comply with ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B.1.6 Deformed-Steel Welded Wire Fabric
Comply with ASTM A 497, flat sheet.

B.2 Reinforcement Accessories
B.2.1 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:

a. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
c. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

B.2.2 Joint Dowel Bars
Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

B.2.3 Epoxy-Coated Joint Dowel Bars
Comply with ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars.

B.2.4 Epoxy Repair Coating
Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 755M.

B.2.5 Zinc Repair Material
Comply with ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

B.3 Fabricating Reinforcement:
Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

C Construction
C.1 Steel Reinforcement
C.1 General
Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

C.1.2 Epoxy-Coated Reinforcement
Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

D Measurement
The department will measure Bar Steel Reinforcement, Structures as a single lump sum unit of work for bar steel reinforcement structures, 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.0105.43	Bar Steel Reinforcement, Structures	LS

Payment is full compensation for furnishing all bar reinforcement as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipmement, and incidentals necessary to complete the contract work.

106. Precast Prestressed Slab Spans, Item SPV.0105.44.

A Description

A.1 General

This special provision describes manufacturing, transporting, and erecting precast prestressed concrete deck panels in accordance to the plans, the pertinent sections of the standard specifications, the American Railway Engineering Association Manual (AREA) for Railway Engineering chapter 8, Parts 1 and 17, and as hereinafter provided.

A.2 Quality Assurance

A.2.1 Installer Qualifications

An experienced manufacturer of precast concrete bridge elements 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 a record of successful in-service performance. Manufacturer shall be certified in accordance to the Precast Concrete institute (PCI) Plant Certification Program. Certification is required in Category B3 for straight strand members and Category B4 for draped strand members.

B Materials

B.1 Concrete

Submit for approval cement mill test reports for chemistry, cement type, air content and compressive strength for conformance with cement specifications on design drawings, shop drawings and referenced standards.

Submit for approval the concrete mix design and admixtures, including aggregate type and gradation for conformance with specifications of design drawings and shop drawings.

Submit for approval the prestressing calculations for strand elongation, elongation corrections and jack gauge pressures for the specified prestress forces on design drawings and shop drawings.

Make and test the cylinders and make available to the engineer all information relating to the making and testing of cylinders. Notify the engineer immediately if concrete cylinder compressive strengths are less than the required 28-day strength. Keep neatly documented records of all cylinder testing on the day of the test and make them available to the engineer. Provide copies of the tests to the engineer by contract completion.

Use concrete in the precast panels that meets the following requirements: grade D concrete; minimum compressive strength of 7500 psi at 28 days; and minimum release strength of 6000 psi.

Concrete strength test checks must ensure adequate concrete strengths are achieved prior to prestress transfer (release) and at 28 days, in accordance to requirements specified on design drawings and shop drawings.

If accelerated curing is used, monitor and record steam cure temperatures in accordance to AREA Chapter 8, Part 1.

B.2 Reinforcing
Submit for approval the mill certificates for prestressing strand and reinforcing bar steels for conformance with specifications of the design drawings and shop drawings.

Position and space the pretensioned reinforcement used in the deck panels as given on the plan. Use pretensioned reinforcement that conforms to the requirements of standard spec 503.2.3.

Use welded wire fabric that meets the requirements of ASTM A-497.

All external or exposed steel shall be epoxy-coated.

B.3 Grout
If grout is used to support the deck panels, use an approved non-shrink, non-chloride grout mixed in accordance to the grout manufacturer's instructions and specifications.

Place after completing erection and adjustment of the panels.

Grout shall consist of Portland cement and water, or Portland cement, water, and approved admixtures.

Mortar and grout shall not be retempered by the addition of water and shall be placed within one hour of mixing.

B.4 Plant Certification
Furnish precast prestressed concrete deck panels that have been manufactured in a plant meeting the requirements of standard spec 503.2.4.

C Construction
C.1 Surface Finish
Score the top surfaces of deck panels with a tining rake or similar tool, parallel to the panel's prestressing strands. Score the top surfaces at 3/4 to 1 inch spacing, and to a depth of 1/8 to 3/16 inch. Remove areas of mortar buildup in excess of 3/8 inch above the top surface of the panel.

C.2 Tolerances

The maximum allowable dimensional tolerances for the deck panels shall be as follows:

Thickness	+ 3/16" or –0"
Length	± 1/4"
Width	± 1/4"
Squareness (difference in diagonal lengths)	1/2"
Location of Strands (measured from bottom of plank to centerline strand)	(panel thickness)/2 ± 1/8"
Bowing	± 1/8"
Sweep	± 1/8"
Warping	1/16 inch per foot of distance from nearest adjacent corner

C.3 Handling and Storing

Handle the precast prestressed concrete deck panels, from the time of releasing the strands until they are in place in the structure, in accordance to standard spec 503 and as hereinafter specified.

Panels having cracks visibly apparent radiating from the strand at the end of the panel will be rejected.

Maintain the panels in a flat position at all times and support the panels at approximately 15 inches from ends. Place the supports at right angles to the strands and ensure that the supports extend the full width of the panel.

During storage and transportation, position the supports such that the panels are maintained in a level position and are not twisted. When panels are stacked, position the supports of all panels in the same vertical planes and ensure that the supports are of adequate thickness to prevent damage to the lifting hooks.

C.4 Transportation, Storage, and Erection

Handle, store and erect all prestressed concrete units in a manner that prevents cracking or other damage to the unit. Discard and replace units damaged by improper handling or storing at no expense to the department.

Transport, handle and store the prestressed planks in an upright position, and ensure that points of support, and direction of the reactions with respect to the units are approximately the same during transportation, storage, and erection as when the unit is in its final position.

Only after attaining a minimum 28-day compressive strength, determined from test cylinders made, cured, and tested, may the contractor transport prestressed concrete units to the work and erect. The engineer may allow delivery and erection of units before their acceptance, pending strength tests, if the contractor provides in writing that it accepts responsibility for their removal and replacement in the event of rejection due to deficient strength.

C.5 Deck

Place the precast prestressed deck panels on rigid cellular polystyrene or fiberboard. Cut and place the polystyrene or fiberboard to form a haunch that produces a uniform total deck thickness. If grout is used to support the panels, place the grout before the cast-in-place deck. A flowable grout may be used after the panels have been set, or a low slump grout may be used and placed immediately before the panels are set. Place the grout a minimum of 3 days before placement of the cast-in-place deck and use wetted burlap to cure the exposed grout.

Prior to placement of concrete over the panels, clean the tops of the panels and ensure that they are free of all foreign material. Immediately prior to placing concrete over the panels, wet the top surface of the panels until free moisture appears and remains.

Place cast-in-place concrete and reinforcement bars in accordance to standard spec 501 and 505 o. Take special care to properly vibrate the concrete at the panel ends over the girders to avoid honeycombs and voids.

D Measurement

The department will measure Precast Prestressed Slab Spans as a single lump sum unit of work for precast prestressed slab spans, 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.0105.44	Precast Prestressed Slab Spans	LS

Payment is full compensation for furnishing all precast concrete units as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

107. Membrane Waterproofing, Item SPV.0105.45.

A Description

A.1 General

This special provision describes furnishing and installing of a Methyl Methacrylate cold liquid spray applied seamless, elastomeric waterproofing system. The spray is applied continuously along the top horizontal surface of the cast-in-place roof and the precast concrete units, the vertically inclined surfaces of the ballast stop curbs, and the back face of the new backwalls of the tunnel structure, in accordance to the details shown on the plans, as directed by the engineer, and as hereinafter provided.

The system is made from a 120 mils (3 mm) MMA based cold liquid spray applied seamless elastomeric waterproofing membrane system, applied in two discrete color-coded coats, to ensure quality control and provide long term protection against corrosion of steel and concrete. A PVC Joint shall be installed over grouted shear key.

The system includes an MMA primer/sealer-healer and protection board shall not be required as the membrane shall withstand direct loading of ballast.

A.2 Submittals

1. Latest edition of Manufacturer's literature including performance data and installation procedures.
2. List of at least five references for similar projects completed to the Client's satisfaction during the past five years in a similar environment and usage in North America. List must include project names, contact names and phone numbers.
3. A 3 inch square sample of the proposed membrane. Colors, texture and thickness shall be representative of overall appearance.

A.3 Job Conditions

A.3.1 Environmental Requirements

a. Application can proceed while air and substrate temperatures are between 14ºF and 120ºF providing the substrate is above the dew point. Below 32ºF, the Manufacturer shall be consulted.
b. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the System.

A.3.2 Safety Requirements

a. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
b. "No Smoking" signs shall be posted at the entrances to the work.
c. Non-product and/or -application-related personnel in the work area shall be kept to a minimum.

A.4 Sequencing and Scheduling

The Applicator, General contractor and the engineer shall agree upon a Schedule for coordination between trades working in the area to receive the System.

A.5 Delivery, Storage and Handling

A.5.1 Packaging and Shipping

All components of the System shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product's type and batch number.

A.5.2 Storage and Protection

The Applicator shall be provided with a storage area for all components. The area shall be cool, dry and out of direct sunlight and in accordance to the Manufacturer's recommendations and all relevant health and safety regulations.

Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the engineer or other personnel.

B Materials

B.1 Primer

Concrete: The primer shall be 100% solvent-free, reactive MMA based, two-component resin capable of a full cure in 40 minutes at 68°F (20°C).

B.2 Membrane

1. The membrane shall be 100% solvent-free, reactive MMA based, two component, spray applied material in two color-coded coats.
2. The membrane shall meet or exceed the following properties as related to laboratory-prepared samples tested at 68°F (20°C) and 24-hour cure where applicable:

Gel Time	6-11 minutes	
Cure Time	30 minutes	
Water Vapor Transmission	1.048 g/ m^2/day	ASTM E96-00, Method A
Adhesion to Concrete	100 psi (0.7 MPa) with failure in concrete	ASTM D4541
Tensile Strength 1,700 psi (11.8 MPa) Heat Ageing @ 160°F (4 weeks) 0% Change	Typical	ASTM D638-91 Die C
Elongation at Break 130% at break Heat Ageing @ 160°F (4 weeks) 0% Change	Typical	ASTM D638-91 Die C
Low Temperature Flexibility (-25°C)	Pass ¼ inch (6.5 mm) Mandrel at -13°F	CAN CGSB 37.50 M89
Dynamic Crack Bridging	Pass @ 10 cycles, 1/8 inch (3.2 mm) -15°F (-26°C)	ASTM C836-00
For Railroads: Dynamic Ballast Impact Test	No damage or leak	SNCF 181kN/2 x 10^6

C Construction

C.1 Inspection

Prior to priming of the surface, the engineer, General contractor and Applicator shall inspect and approve the prepared substrate.

Random tests for adequate tensile bond strength shall be conducted on the substrate by the Applicator at the job site using an Elcometer Adhesion Tester Model 106 or similar at a minimum frequency of one per 5,000 ft^2 (500 m^2). Smaller areas shall receive a minimum of three tests.

Adequate surface preparation will be indicated by tensile bond strengths of primer to the substrate greater than or equal to:

i. Concrete: 100 psi minimum (0.7 MPa), with failure in the concrete.

Should the tensile bond strengths be lower than the minimum specified, the engineer may request additional substrate preparation.

Joints shall be treated in accordance to the Manufacturer's recommendations as approved or directed by the engineer.

C.2 Preparation

C.2.1 Protection

The Applicator shall be responsible for the protection of equipment and adjacent areas from overspray or other contamination.

C.2.2 Surface Preparation

C.2.2.1 Concrete

Concrete shall have cured for a minimum of seven days in accordance to ACI308. For concrete newer than this the Manufacturer shall be consulted.

Surfaces shall be free of any oil, grease, curing compounds, laitance, loose particles and friable matter, moss and algal growth, dirt, bituminous products, and previous waterproofing materials. If required, degreasing shall be performed via detergent washing in accordance to ASTM D4258.

There shall be no visible moisture present on the surface at the time of the application of the System. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.

Removal of contaminants and surface preparation shall be performed by means approved by the engineer to an agreed standard.

The surface shall be abrasively cleaned, in accordance to ASTM D4259, to provide a substrate free from laitance.

The substrate shall be sounded and all spalls repaired prior to placement of the primer coat. Spalls shall be repaired with rapid-cure concrete patch materials as per the engineer’s and Manufacturer’s recommendations.

Voids and blowholes on vertical surfaces shall be repaired in the same manner.

The surface profile of the concrete is not to exceed 1/4 inch (6 mm) peak-to-valley, and areas of minor surface deterioration of 1/2 inch (13 mm) and greater shall also be repaired to prevent excessive product usage. The extent and location of thin surface patches shall require the approval of the engineer before the System is applied.

C.2.2.1 Related Material
The Manufacturer shall be consulted to determine feasibility of application and recommended preparation.

C.3 Application
The System shall be applied in distinct steps as listed below:

a. Substrate preparation
b. Priming
c. PVC Joint Installation
d. Membrane application

Immediately prior to the application of any components of the System the surface shall be dry and any remaining dust or loose particles shall be removed using clean, dry oil-free compressed air or industrial vacuum.

Where the area to be treated is bound by a vertical surface (e.g. curb or wall), the System may be continued up the vertical as necessary.

The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance to the Manufacturer's recommendations or as approved or directed by the engineer.

A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

C.3.1 Primer
For all substrates, the primer shall consist of one coat with an overall coverage rate of 125-150 ft^2/gal.

All components shall be measured and mixed in accordance to the Manufacturer's recommendations.

The concrete and steel primers shall be applied using a roller or, for concrete only, by a single component spray system approved for use by the Manufacturer. If required by site conditions, brush application shall be allowed.

Porous concrete may require a second primer coat should the first coat be absorbed.

Flat PVC Joint Installation over grouted joint.

C.3.2 Surface Preparation

It should be stressed that the success of any bonded joint system is dependent on the thoroughness of the surface preparation. Joint Nosings must be structurally sound and to true lines both horizontally and vertically. The nosings must be level. If a height difference exists of between 10mm and 40mm this must be corrected using Metaset Repair Mortar.

C.3.3 Concrete

Concrete should be a minimum of seven days old. If additives, cement replacement or curing agents have been used please contact us. All surfaces to be treated must be dry and free from oil, grease, curing compounds, loose particles, moss and algae growth, laitance, friable matter, dirt and all other contaminants. All concrete areas must be prepared by suitable mechanical meanssuch as mechanical blasting or grit blasting to provide a sound surface free from laitance. Damaged areas of concrete should be repaired using a methyl-methacrylate repair material.

Prior to application of the PVC Joint, the concrete substrate must be primed with Par1 Primer with a coverage rate of approximately 125 square feet gallon. The Par1 primer shall be applied evenly to the substrate by brush or roller.

Once primer is cured, install Debonding tape centered over the joint.

Wherever possible, continuous unbroken lengths of the PVC Joint should be used.

The PVC Joint must be adhered with methyl-methacrylate structural adhesive to the concrete surface.

The PVC Joint must be relaxed and flat before installation begins. The joint shall be first cleaned with an acetone wipe.

Apply the properly mixed methyl-methacrylate structural adhesive along the joint nosings at a minimum thickness of 1mm using a brush, trowel or similar tool. The PVC Joint must be placed immediately after the adhesive is applied and before it starts to cure. Apply gentle pressure from the center of the PVC Joint outwards and squeeze out all the residual material from the sides. Remove any excess adhesive that is squeezed out from under the joint.

If the PVC Joint is to be lapped, the two lengths of joint should be overlapped by a minimum of 50mm. Ensure the section to be overlapped is clean. Apply a liberal layer of methyl-methacrylate structural adhesive over the area of the joint length to be overlapped and then overlay with the next joint length. Apply gentle pressure from the center outwards and squeeze out the residual material from the sides. Remove any excess adhesive and allow the joint to cure fully. Once cured, check the integrity of the joint before continuing.

Once fully installed, place de-bonding tape centered over PVC Joint. Apply properly mixed methyl-methacrylate structural adhesive onto the PVC Joint at a minimum thickness of 1mm using a brush, trowel or similar tool. Allow the methyl-methacrylate structural adhesive to fully cure before applying the two-coats of membrane over the PVC Joint.

C.3.4 Membrane

The waterproofing membrane shall consist of two spray-applied coats, each of a different color and with a wet film thickness of 60 mils (1.5 mm) per coat, to achieve an overall coverage rate of 13.4 ft^2/gal (0.33 m^2/lt).

The membrane shall be comprised of two liquid components, A and B, and a Hardener Powder, which is to be added to Component B in accordance to the Manufacturer's recommendations.

The substrate shall be coated in a methodical manner. Checks for wet film thickness shall be carried out typically once every 100 ft^2 (9 m^2).

C.3.5 Repairs

If an area is left untreated or the membrane becomes damaged, a patch repair shall be carried out to restore the integrity of the System. The damaged area shall be cut back to sound materials and wiped with solvent (e.g. acetone) up to a width of at least 2 inch (50 mm) on the periphery, removing any contaminants. The substrate shall be primed as necessary, followed by the application of the membrane. A continuous layer shall be obtained over the substrate with a 2 inch (50 mm) overlap onto existing membrane.

Where the membrane is to be joined to existing cured material and at day joints, the new application shall overlap the existing one by at least 2 inches (50 mm). No preparation shall be necessary unless the existing materials are contaminated with tack coat or dirt in which case the repair/overlap shall first be wiped with solvent (e.g. acetone).

C.4 Field Quality Control

The following tests shall be conducted by the Applicator or Manufacturer's representative and recorded on a form to be submitted to the engineer.

C.4.1 Temperature

Air, substrate temperatures and dew point. Dew point shall be calculated from temperature and humidity using standard tables.

C.4.2 Adhesion Tests

Adhesion tests of the cured membrane to the substrate shall be checked as per Clause 3.1 A.

C.4.3 Membrane Thickness

Wet film thickness shall be checked every 100 ft^2 (9 m^2) using a gauge pin standard comb-type thickness gauge.

C.4.4 Coverage Rates
Rates for all layers shall be monitored by checking quantity of material used against the area covered.

C.5 Final Review
The engineer, General contractor and Applicator shall jointly review the deck area(s) to which the completed System has been installed. Any irregularities or other items that do not meet the requirements of the engineer shall be addressed at this time.

D Measurement
The department will measure Membrane Waterproofing as a single lump sum unit of work for membrane waterproofing, 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.0105.45	Membrane Waterproofing	LS

Payment is full compensation for waterproofing membrane systems as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

108. Compacted Backfill, Item SPV.0105.46.

A Description
This special provision includes preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings. This special provision describes backfilling for buildings and structures.

B Materials
Materials shall be administered as set forth in standard spec 210.

C Construction
Construct in accordance to standard spec 210.

D Measurement
The department will measure Compacted Backfill as a single lump sum unit of work for compacted backfill, 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.0105.46	Compacted Backfill	LS

Payment is full compensation for compacted backfill areas as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

109. Structural Steel, Sections 05 12 00 and 05 12 50, Item SPV.0105.47.

A Description

This specification includes requirements regarding the fabrication, transportation, delivery, and erection of structural steel framing members, support members, welds, fasteners, base plates, anchor rods, bearing plates, shear stud connectors, and non-shrink grout, shown on the architectural and structural drawings inferable there from and specified herein. This specification also includes requirements regarding the fabrication, transportation, delivery, appearance, surface preparation, and erection of Architecturally Exposed Structural Steel (AESS).

B Materials

B.1 Structural Steel W-Shape Members
Comply with ASTM A992, Fy = 50ksi

B.2 Structural Steel Angles, Plates, Channels and Other Rolled Members
Comply with ASTM A36, Fy =36 ksi; or ASTM A572, Fy = 50ksi.

B.3 Rectangular or Square (HSS) Hollow Structural Sections
Comply with ASTM A500, Grade B, Fy = 46 ksi

B.4 Round (HSS) Hollow Structural Sections
Comply with ASTM A500, Grade B, Fy = 42 ksi

B.5 Steel Pipe
Comply with ASTM A53, Grade B, Fy = 35 ksi

B.6 Shear Stud Connectors
Comply with ASTM A108 Grade 1015, Fu = 60 ksi, Forged Steel, headed and uncoated

B.7 Bolts, Nuts, and Washers
Comply with ASTM A325 High-Strength Bolts, Type 1 – Medium Carbon

Carbon Boron or Medium Carbon Alloy Steel finish; with ASTM A563 heavy hex nuts and ASTM F436 washers, head markings or bolts, fully traceable

B.8 Bolts, Nuts, and Washers
Comply with ASTM A490 High-Strength Bolts, Type 1 – Medium Carbon

Carbon Boron or Medium Carbon Alloy Steel finish; with ASTM A563 heavy hex nuts and ASTM F436 washers, head markings or bolts, fully traceable

B.9 Threaded Anchor Bolts (Anchor Rods)
Comply with ASTM F1554, Class 2A threads; Grade 36; straight; headless with ASTM A563 heavy hex nuts, and ASTM F436, Type 1 washers.

B.10 Non-Shrink Grout
Pre-mixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 7000 psi.

B.11 Shop Primer
Non-AESS designated interior steel receiving no additional coatings: Universal Metal Primer for Structural Steel red.

AESS: Primer compatible with finish specified under Painting, Section 09 91 00. The General contractor shall submit all components/procedures of the paint system for AESS as a single coordinated submittal. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable) and finish coat. All of the items shall be coordinated with the finish coat specified per the 'Painting' section.

C Construction
C.1 Fabrication
C.1.1 Fabrication – Non AESS
Fabricate items of structural steel in accordance to AISC specifications, and as shown on approved shop drawings.

Field connections are to be bolted unless welded, or other types of connections are indicated.

Bolted Connections shall be made with ASTM A325 high strength bolts, unless otherwise noted.

Connections shall support a minimum of one half of the maximum total factored uniform load capacity shown in the AISC LRFD tables for factored loads on beams for the given shape, span, and steel specified, unless otherwise noted.

Connections shall be made with standard double angles unless otherwise noted.

Install high strength threaded fasteners in accordance to RCSC – "Specifications for Structural Joints Using ASTM A325 or A490 bolts".

Welding shall comply with AISC and AWS Codes for procedures, appearance, quality of welds, and for methods used in correcting welding work.

All welds shall be made by pre-qualified welders, certified for welds made.

Minimum size of fillet welds shall be as specified in Table J2.4 of AISC Manual of Steel Construction.

All members with moment connections, noted on drawings, shall be welded to develop full flexural capacity of member, unless noted otherwise on drawings.

Minimum Strength of Welded Connections: Unless noted otherwise on drawings, all shop and field welds shall develop full tensile strength of member of element joined.

Provide holes required for securing other work to structural steel framing and for passage of other work through steel members, as shown on approved shop drawings.

Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

Verify or supplement dimensions shown on Drawings by field measurements to assure fit of new work.

Jointed members shall be sealed with continuous welds unless otherwise noted.

C.1.2 Fabrication - AESS

Make in accordance to the 'Fabricaton – Non AESS' section as amended herein.

Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the engineer. Detail AESS assemblies to minimize field handling and expedite erection.

Provide mock-up of surfaces, connections, and finishes as required in the specifications below. If approved by the engineer, incorporate mock-up into the work or remove from the site after project completion.

Fabricate AESS with exposed surfaces smooth, square and of surface quality consistent with the approved mock up. Use special care in handling and shipping of AESS both before and after shop painting.

Fabricate steel to one half the normal tolerance as specified in accordance to AISC specifications, and as shown on approved shop drawings.

Fabricator shall grind welds of AESS smooth. For groove welds, the weld shall be made flush to the surfaces each side and be within +1/16", -0" of plate thickness.

Where fillet welds are indicated to be ground-contoured, or blended, oversize welds as required and grind to provide a smooth transition and to match profile on approved mock-up.

Where welding is noted on the drawings, provide continuous welds of a uniform size and profile.

At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.

Maintain a uniform gap of 1/8" ± 1/32" at all copes and blocks.

Maintain a uniform joint gap tolerance of 1/8" ± 1/32".

Fabricate such that piece marks are fully hidden in the final structure or made with such media to permit full removal after erection.

Fabricator shall deliver steel with no mill marks (stenciled, stamped, raised etc) in exposed locations. Mill marks shall be omitted by cutting of mill material to appropriate lengths where possible. Where not possible, the fabricator can fill and/or grind to a surface finish consistent with the approved mock up.

Fabricator shall grind all edges of sheared, punched or flamecut steel to match approved mockup.

Members specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem, and of outstanding flanges or legs of angles shall be visibly acceptable to the engineer from a distance of 20' under any lighting condition determined by the engineer. Tolerances for the vertical and horizontal walls of rectangular HSS members after rolling shall be the specified dimension ±½".

Seal weld open ends of round and rectangular hollow structural section with 3/8" closure plates. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where AESS is exposed to weather.

Align bolt heads as indicated on the approved shop erection drawings.

Comply with AWS D1.1. Appearance and quality of welds shall be consistent with the mock up. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding the tolerance of this section.

C.2 Finish

C.2.1 Finish – Non AESS

Prepare interior structural component surfaces for general work in accordance to SSPC – SP1 and SP3 as a minimum.

Prepare structural component surfaces of exterior steel in accordance to SSPC – SP1 and SP6 as a minimum.

Coated surfaces, interior or exterior, shall be prepared in accordance to coating manufacturer's SSPC requirements if more stringent than listed above.

Shop Primed Structural Steel Members: Minimum one coat for interior steel, minimum two coats for exterior steel. Primer coats shall be a minimum of 2.4 mils dry thickness unless manufacturer has more stringent requirements.

Do not prime surfaces that will be fireproofed, in contact with concrete. Do not prime surfaces that will be field welded unless coated with a weldable primer.

C.2.2 Finish – AESS

C.2.2.1 Shop Priming

Shop-prime steel surfaces, except the following:

a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2".
b. Surfaces to be field welded.
c. Surfaces to be high-strength bolted with slip-critical connections, if primer does not meet specified AISC slip coefficient.

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:

a. SSPC-SP 1 "Solvent Cleaning"
b. SSPC-SP 2 "Hand Tool Cleaning"
c. SSPC-SP 3 "Power Tool Cleaning"

Immediately after surface preparation, apply primer according to manufacturer's instructions 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.

Stripe paint corners, crevices, bolts, welds, and sharp edges.

Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

C.2.2.2 Adjusting and Cleaning

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touch up work shall be done in accordance to manufacturer's instructions as specified in "Painting" section.

C.3 Installation and Storage

Verify that field conditions are acceptable and are ready to receive work in accordance to Drawings and shop drawings.

Check all AESS members upon delivery for twist, kinks, gouges or other imperfections which might result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

Verify anchors and anchor rods have been preset into connection work in accordance to Drawings and shop drawings.

For AESS provide connections for temporary shoring, bracing and supports only where noted on the approved shop drawings. Temporary connections not shown shall be made at locations not exposed to view in the final structure or as approved by the engineer. Handle, lift and align pieces using padded slings and/or other protection required to maintain the appearance of the AESS through the process of erection.

Beginning of installation and erection means that existing conditions have been checked and found acceptable.

Cost of corrections shall be borne by this section if variances are not identified prior to start of installation.

Erect structural steel in accordance to AISC Specifications.

Set AESS accurately in locations and to elevations indicated, and according to AISC specifications referenced in this section.

For AESS, in addition to the special care used to handle and erect AESS, employ the following erection techniques:

a. Erection tolerances shall meet the requirements of standard frame tolerances for structural steel per Chapter 7 of the AISC Code of Standard Practice.
b. Erector shall grind welds smooth in the connections of AESS members. For groove welds, the weld shall be made flush to the surfaces of each side and be within + 1/16”, -0” of plate thickness.
c. Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required; grind to provide a smooth transition and to match profile on approved mock-up.
d. Where noted on the drawings, provide continuous welds of a uniform size and profile.
e. At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
f. Run-out tabs, erection bolts and other steel members added to connections to allow for alignment, fit-up, and welding in the field shall be removed from the structure. Field groove welds shall be selected to eliminate the need for backing bars or to permit their removal after welding. Welds at run-out tabs shall be removed to match adjacent surfaces and ground smooth. Holes for erection bolts shall be plug welded and ground smooth.
g. Where holes must be cut in the web at the intersection with flanges on W shapes and structural tees to permit field welding of the flanges, they shall be filled. Filling shall be executed with proper procedures to minimize restraint and address thermal stresses in group 4 and 5 shapes.

h. All seams shall face upward in the final erected position of all horizontal members.
i. Weld profile, quality, and finish shall be consistent with mock-ups approved prior to fabrication.

Store steel on site on substantial shores or blocking to keep free of ground and to prevent bending, buckling, or twisting.

Prevent water collection on members.

Provide for erection loads, wind and dead loads, and provide sufficient temporary bracing to maintain structure in safe, plumb, and true alignment until completion of erection and installation of permanent bracing.

Do not final bolt or weld until structure has properly aligned and plumbed.

Obtain permission for any torch cutting or field fabrication from the engineer. For AESS, finish sections thermally cut during erection to a surface appearance consistent with the mock up.

Do not field cut or alter structural members without prior approval of Professional engineer of Record.

Splice members only where indicated on approved shop drawings.

Field weld components indicated on Drawings and shop drawings.

For AESS, assemble and weld built-up sections by methods that will maintain true alignment of axes without warp. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances. Obtain engineer's approval for appearance of welds in repaired or field modified work.

All bolted joints may be installed as Snug Tightened joints as specified and permitted in the RCSC – Specification, unless otherwise noted.

Pretension all high strength bolts for Pretension or Slip-Critical (S.C.) Joints to minimum bolt pretension specified in Table 8.1 or RCSC – Specification for Structural Joints Using ASTM A325 or A490 bolts, 2004 Edition. Tension shall be achieved using twist-off type tension-controlled bolt assembly.

For non-AESS, 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.

Grout solid under base plates in accordance to AISC – Code of Standard Practice for Steel Buildings and Bridges.

Contact surfaces of field connections shall be free from dust, oil, loose scales, burrs, pits, and other defects that prevent solid seating of parts.

Clean all surfaces of dirt, mud, oil, or grease that would impair bonding of fireproofing or concrete.

Reaming is not allowed if reaming weakens or makes impossible to fill holes or adjust accurately after being reamed.

For AESS, do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.

For Non-AESS, Maximum Variation from Plumb: ¼ inch per story, non-cumulative

For Non-AESS, Maximum Offset from True Alignment: ¼ inch

C.4 Submittals

C.4.1 Shop and Erection Drawings

Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, and fasteners

Show all connections. Connections shall be designed and drawings and calculations shall be Stamped/Sealed by Professional engineer, registered in State of Wisconsin, who is responsible for connection design.

Show cambers and loads.

Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths. Indicate cleaning and painting specifications.

Assume responsibility for dimensional errors.

Field verify dimensions affected by existing construction prior to submitting Shop Drawings and so note verified dimensions on shop drawings.

Field verify existing anchor bolt placements and modify base plates to accommodate field conditions.

Fabricator shall check shop drawings before Submittal

Shop drawings, which include the following and have been prepared under supervision of a Professional engineer registered in the State of Wisconsin, shall bear seal and signature of supervising design engineer: Calculations, connection drawings, job standards, and any other items that are performance specified or designed by contractor’s engineer.

Provide holes for installation of other work.

Any omission from shop drawings of any materials required by Contract Documents shall not relieve contractor of responsibility of furnishing and installing such materials, even though shop drawings may have been reviewed and approved.

C.4.2 Manufacturer's Mill Certificate
Submit documentation certifying that products meet or exceed specified requirements.

C.4.3 Mill Test Reports
Submit Manufacturer's Certificates, indicating structural strength, destructive and non-destructive test analysis.

C.4.4 Welders Certificates
Submit Manufacturer's Certificates, certifying welders employed on the work, verifying AWS qualification within the previous 12 months.

D Measurement
The department will measure Structural Steel as a single lump sum unit of work for structural steel framing acceptably completed. For AESS, the engineer will observe the AESS steel in place and determine its visual acceptability based on the approved mockup.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.47	Structural Steel	LS

Payment is full compensation for furnishing and installing all materials as per the plans, details, schedules, and these special provisions; and for furnishing all labor tools, equipment, and incidentals necessary to complete the contract work.

110. Steel Floor Decking, Section 05 31 13, Item SPV.0105.48.

A Description
The fabrication, furnishing and installation of cold-framed sheet steel roof deck spanning the full width between steel beams on the mezzanine as shown on the architectural and structural drawings, inferable there from and specified herein.

B Materials
The composite floor deck shall be cold-formed from 18 gage, steel coils conforming to ASTM A653, structural quality with a minimum yield strength of 40 Ksi.

Steel coils shall receive prior to forming a hot-dipped protective coating of zinc conforming to ASTM A924 Class G90 as defined by ASTM A653.

Fasteners to be carbon steel, self-tapping screws. Framing connections - #12 minimum; deck stitch connection - #10 minimum.

C Construction

C.1 Fabrication

Design metal deck in accordance to Steel Deck Institute (SDI) Design Manual.

See Drawings for depth and gage requirements.

Side Joints to be lapped.

Fluted Sides to be diagonally ribbed for improved concrete bond.

Approved manufacturers

a. Epic Metals Corp.
b. United Steel Deck, Inc.
c. Vulcraft
d. Wheeling Corrugating Co.
e. Approved equal.

C.2 Installation and Storage

Steel deck shall be stored off ground with one end elevated to provide drainage and shall be protected from elements with a waterproofing covering, ventilated to avoid condensation.

Before being permanently fastened, the roof deck shall be adjusted to a final position with the ends accurately aligned.

Erect metal decking in accordance to SDI Design Manual for Composite Decks, Form Decks, Roof Decks and as further specified on Drawings.

The cutting of openings for the installation of ventilation equipment where shown on the drawings and any other field cutting shall be performed by qualified personnel in a neat and workmanlike manner.

The roof deck shall be fastened to all supporting framing with screws not more than 12 inches on center maximum.

The roof deck side laps shall be fastened together with screws not more than 36” on center maximum.

Damaged galvanizing and other coatings must be field repaired, leaving an installation where the surfaces are clean and ready for a finish coat field painting.

Bear decking on steel supports 1-1/2 inch minimum.

To contain wet concrete, install stops at floor edge upturned to top surface of slab. Provide stops of sufficient strength to remain stationary under wet concrete without distortion.

Weld stud shear connectors through steel deck to structural members below.

Immediately after welding components in position, clean and coat welds, burned areas, and damaged surface coating with touch-up prime paint.

Butt deck ends over supports when stud shear connectors are used.

C.3 Submittal

C.3.1 Shop Drawings

Indicate deck layout, types of deck units, support locations, side laps, end laps, anchorage details, closure strip details, supplementary framing, cut openings, and other accessories.

C.3.2 Product Data

Provide deck profile characteristics and dimensions and structural properties.

C.3.3 Manufacturer's Installation Instructions

Indicate specific installation sequence and special instructions.

D Measurement

The department will measure Steel Floor Decking as a single lump sum unit of work for steel floor deck, 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.0105.48	Steel Floor Decking	LS

Payment is full compensation for furnishing and installing steel floor deck as per the plan details, these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

111. Floor Grinding, Item SPV.0105.49.

A Description

This special provision describes diamond grinding the surface of the existing concrete in a longitudinal direction, as directed by the engineer, and as hereinafter provided.

B (Vacant)

C Construction
Diamond grind the surface area of the concrete in a manner that results in 95 percent of any 3-foot x 100-foot section of floor area having a grooved or corduroy-type appearance. The grooves shall be approximately 1/16-inch from peak to bottom, and shall be uniformly spaced a minimum of 50 blades per linear foot.

After grinding, test the concrete surface with a ten-foot straightedge or with a profilograph. Mark and correct all areas showing a deviation of more than 1/8-inch in ten feet with the straightedge or a deviation of more than 0.4 inches in 25 feet as determined by the profilograph.

When tested with a straightedge placed perpendicular to the centerline, the transverse slope of the deck shall be uniform to a degree that no depressions or misalignment of slope greater than 1/8-inch in three feet are present. Straightedge requirements do not apply across longitudinal joints. Maintain positive transverse drainage.

Remove all solid and liquid residues from grinding by vacuuming the floor. Residue and water shall not be permitted to flow or be blown across platforms used by public traffic. Dispose of residue and water at an acceptable disposal site.

D Measurement
The department will measure Floor Grinding as a single lump sum unit of work for floor grinding, 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.0105.49	Floor Grinding	LS

Payment is full compensation for floor grinding as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

112. Clean Tunnel Drain Tiles, Item SPV.0105.50.

A Description
This special provision describes the cleaning of the existing tunnel drainage system.

B (Vacant)

C Construction
C.1 Examination
Examine existing drain tiles for suitable conditions.

Proceed with cleaning only after unsatisfactory conditions have been identified.

C.2 Installation
Repair any portion of the drain tile that has been damaged or rusted.

Replace any drain tile that has been damaged or rusted beyond repair.

C.3 Cleaning
Clear interior of piping and drainage structures of dirt and other superfluous material.

Maintain swab or drag in piping and pull past each joint as it is completed.

Place plugs in ends of uncompleted pipe at end of each day or when work stops.

C.4 Field Quality Control
C.4.1 Testing
Test drain piping with water to ensure free flow before any backfilling.

Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

D Measurement
The department will measure Clean Tunnel Drain Tiles as a single lump sum unit of work for cleaning tunnel drain tiles, 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.0105.50	Clean Tunnel Drain Tiles	LS

Payment is full compensation for furnishing all cleaned tunnel drain tiles as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

113. Storm Sewer Installations and Alterations, Item SPV.0105.51.

A Description
This special provision describes the construction of the storm sewer pipes and structures in accordance to standard spec 607, 608, and 611, as shown in the plans, and as hereinafter provided. Follow any provisions specified as part of storm water and plumbing approvals. The department will provide the approval provisions to the contractor.

B Materials
Provide Class III reinforced concrete pipe materials meeting the requirements of standard spec 607.2 and 608.2.

Provide Grade B smooth steel pipe materials with minimum yield strength of 35,000 psi. Smooth steel pipe shall have a welded straight longitudinal seam; the ends of each section of pipe shall be beveled for field welding sections together. Minimum thickness of pipes 12-inch or less in diameter shall be ¼-inch; minimum thickness of pipes over 12-inch diameter and less than or equal to 18-inch diameter shall be 5/16-inch.

Provide ductile iron pipe and polyvinyl chloride pipe per the Standard Specifications for Sewer and Water Construction in Wisconsin, Latest Edition.

Provide inlets and manholes in accordance to standard spec 611.2 and to the dimensions shown in the plans. Design all manholes, inlets and catch basins for Cooper E80 surcharge.

Provide polyvinyl chloride pipe SDR 35 or better.

C Construction
Construction must meet the requirements of standard spec 607.3 and standard spec 611.3.

Structures shall be cleaned of any accumulation of silt, debris or foreign matter of any kind, and shall be free of any such accumulation at the time of final inspection.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.51	Storm Sewer Installations and Alterations	LS

Payment is full compensation for furnishing all materials; excavating and backfilling where necessary; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work as per the plans, details, schedules, and these special provisions. Included in, but not limited to, contract work is cleaning structures and pipes to the river outfalls, storm sewer layout, connections to existing pipes, removals, storm sewer, storm sewer structures, steel restrictor plate secured inside structure, frame and grates, underdrains, tunnel sump, depot building sump, two United States Postal Service connections, and connections from downspouts to storm sewer. The tunnel sump outfall is to be replaced in kind, and connected to storm sewer system.

114. Erosion Control and Inlet Protection, Item SPV.0105.52.

A Description
This special provision describes the installation, monitoring and maintenance of erosion control.

B Materials
Provide materials including, but not limited to, silt fence and inlet protection per standard detail drawings and as specified in standard spec 628.

C Construction
Construction silt fence and inlet protection per standard detail drawings and as specified in standard spec 628.

D Measurement
The department will measure Erosion Control and Inlet Protection as a single lump sum unit of work for erosion control and inlet protection, 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.0105.52	Erosion Control and Inlet Protection	LS

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

115. Sediment Tank, Item SPV.0105.53.

A Description
This special provision describes the constructing of a sediment tank of sufficient size to provide an effective means to filter the water from the dewatering operation before it is discharged into the sanitary sewer in accordance to the details shown on the plans and as hereinafter provided. Work must be in accordance to the Milwaukee Metropolitan Sewerage District Discharge Regulations.

B Materials
Provide materials that meet the DNR standards for de-watering. Provide Geotextile Fabric, Type DF of the schedule necessary to meet the pumping rate used according to standard spec 645.2.4.

C Construction
Provide the dimensions of the sediment tank to the engineer for approval prior to construction. Size the tank following the DNR standards for de-watering. Loam and silt materials are expected to be filtered from the water. Outlet the sediment tank into the sanitary sewer. Clean and maintain the sediment tank to assure proper functioning as directed by the engineer.

D Measurement
The department will measure Sediment Tank as a single lump sum unit of work for sediment tank, 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.0105.53	Sediment Tank	LS

Payment is full compensation for furnishing all materials, for any maintenance, for disposing of surplus materials and filtered sediments, for removal of the basin after completion of the dewatering operations, and for furnishing all labor, tools, equipment and incidentals necessary to complete the work in accordance to the contract.

116. Shed Demolition, Item SPV.0105.54.

A Description

This special provision includes the demolition and removal of the train shed canopy and disposing and/or salvaging the resulting materials as shown on the plans, in accordance to the standard specifications, and as hereinafter provided.

A.1 Submittals

A.1.1 Qualification Data

Submit qualification data for demolition firm.

A.1.2 Demolition Plan

The contractor shall be responsible for the methods and sequence of demolition, including effects on the overall stability of the building structure being removed. Prior to mobilization to the site, submit a Demolition Plan for review to ascertain compliance with the requirements specified. The plan shall include written procedures, schedules, and drawings as applicable. The Demolition Plan shall, at a minimum, address the following:

a. The name of the professional engineer, registered in the state of Wisconsin, who will be on-site to monitor the removal of the structures as required in this specification.
b. The name of the contractor's on-site-employee designated as being in charge of all removal operations.
c. The removal method and the sequence of the removal of the structure.
d. Analysis of the stability of the structure based on the methods and sequence of demolition proposed, to ensure that the structure is demolished in a safe and controlled manner. The analysis computations shall be prepared, and signed and sealed by a professional engineer registered in the state of Wisconsin.
e. Design and details of temporary supports, and shoring or temporary bracing required to stabilize remaining structures in the area during the removal. Include design computations and detail drawings for all temporary supports, shoring and bracing that indicate the exact placement of the temporary supports, verification of design loads, and attachment details. Temporary support, shoring, or bracing design computations and drawing details are to be prepared, and signed and sealed by a professional engineer registered in the State of Wisconsin.
f. Design and details of temporary support foundations. Temporary support foundation design computations and drawing details are to be prepared, and signed and sealed by a professional engineer registered in the State of Wisconsin.
g. Equipment type and the locations of the equipment on the structure or adjacent roadways and bridges during the removal operations.

h. Locations and type of work to be performed directly adjacent to traffic.
i. Details and locations of protective covers and other measures to ensure that people, property, and improvements will not be endangered or damaged as a result of the removal operations. This shall include methods for protecting the adjacent structures, and the pavement surface.
j. Methods of removal and disposal, the proposed haul route, the method of hauling, and the proposed destination.
k. A schedule of anticipated roadway and lane closures to accommodate removal operations. Include the timing of individual lane or temporary roadway closures and the nature of the removal operations that will be performed during the lane or roadway closures.
l. Acknowledgement that the contractor and removal design engineer responsible for preparing the removal plan have visited the site and reviewed the existing structure plans in preparing the removal plan.

Provide five copies of the removal plan to the engineer a minimum of one week prior to beginning demolition work for review.

It is understood that, whether or not the engineer concurs in the removal plan as submitted or revised, the contractor will in no way be relieved of the responsibility of providing a safe and controlled removal operation. Nor will the contractor be relieved of the responsibility of maintaining the stability of the remaining structures or portions thereof during demolition and construction.

A.1.3 Proposed environmental protection, dust control and noise control measures
Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

A.1.4 Schedule of Building Demolition Activities
Indicate the following:
a. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
b. Interruption of utility services.
c. Coordination for shutoff, capping, and continuation of utility services.
d. Locations of temporary protection and means of egress, including for other tenants affected by building demolition operations.
e. Coordination of owner's continuing occupancy of adjacent buildings and partial use of premises.

A.1.5 Inventory
After demolition is complete, submit a list of items that have been removed and salvaged.
Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

A.2 Quality Assurance

A.2.1 Demolition Firm Qualifications

An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this project.

A.2.2 Regulatory Requirements

Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

A.2.3 Standards

Comply with ANSI A10.6 and NFPA 241.

A.2.4 Predemolition Conference

Conduct conference at project site a minimum of one week prior to the beginning of demolition operations.

A.3 Project Conditions

Owner will occupy buildings immediately adjacent to and connected to the demolition area. Conduct building demolition so owner's and neighbors operations will not be disrupted.

Provide not less than 72 hours notice to owner and neighbor of activities that will affect owner's and neighbor's operations.

Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.

Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction.

Storage or sale of removed items or materials on-site is not permitted.

A.4 Coordination

Arrange demolition schedule so as not to interfere with owner's and other tenants' on-site operations.

B (Vacant)

C Construction

C.1 Examination

Survey existing conditions and correlate with requirements indicated to determine extent of concrete demolition required.

Review project record documents of existing construction provided by the engineer. Owner does not guarantee that existing conditions are the same as those indicated in project record documents.

Inventory and record the condition of items to be removed and salvaged.

When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to engineer.

Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

Verify that hazardous materials have been remediated before proceeding with building demolition operations.

C.2 Preparation

C.2.1 Existing Utilities

Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

Owner will arrange to shut off indicated utilities when requested by contractor.

Arrange to shut off indicated utilities with utility companies.

If utility services are required to be removed, relocated, or abandoned, before proceeding with building demolition provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

C.2.2 Lead Based Paint

Mr. Steven Marcinkowski, certified lead sampling technician License Number LST-106015, and Mr. Bruce Benoit performed a lead-based paint survey of the train shed structure located at 433 W. St. Paul Avenue, Milwaukee, Wisconsin on August 23, 2007. Lead-based paint (LBP) was identified at locations within the structure as described in the report entitled “Pre-Renovation/Demolition Lead-Based Paint Survey Report, Milwaukee Intermodal Station – Train Shed. 433 West St. Paul Avenue, Milwaukee, Wisconsin” prepared by Sigma Environmental Services, Inc. and dated September 2007.

C.2.2.1 Regulatory Requirements

a. Comply with all applicable rules, regulations, codes and ordinances of Local, State and Federal Authorities including but not limited to:
b. Local Authority - Abide by all local requirements which pertain to lead exposure.

c. State Authority - Wisconsin Administrative Code:
   ILHR Chapter 32 Safety and Health Standards for Public Employees
   NR Chapter 427 Control of Lead Emissions
d. Federal Authority - Code of Federal Regulations:
   40 CFR Protection of the Environment
   29 CFR Labor; specifically including but not limited to:
      29 CFR Part 1926: Safety and Health Regulations for Construction, specifically including but not limited to:
         Subpart Z - Toxic and Hazardous Substances
e. WDNR Publication WA-605 2004, Concrete Recycling and Disposal Fact Sheet

C.2.2.2 Submittals

a. Submit the results of any lead testing to the engineer.
b. Submit information on any proposed operations to remove or strip lead paint to the engineer. Such chemicals or materials shall not be used unless approved by the engineer. Information required for submittal includes, but is not limited to product description, MSDS sheets and chemical composition.

C.2.2.3 Work Procedures

a. The presence of lead based paint within the work area has been documented.
b. Notify all employees involved in the work in accordance to DNR and OSHA regulations. Employees must be fully trained in the requirements of 29 CFR Part 1926.62, and must be aware of the health effects of lead on them.
c. Read and understand 1926.62, and comply with the requirements spelled out within. These include, but are not limited to, physical evaluations for all field personnel that may wear personal respiratory protection, based upon expected lead exposure conditions determined by the each contractor's assessment of the job's scope. Such evaluations include baseline blood-lead levels of workers to determine if an employee has a pre-existing lead condition. Workers shall be prepared to undergo medical monitoring for lead if necessary.
d. Have a respiratory protection program in-place in accordance to OSHA 1910.134.
e. Make provisions to accommodate cost associated with providing continued lead exposure protection.
f. Perform an Initial Exposure Assessment: Determine whether any employee may be exposed to lead at or above the permissible exposure limit (PEL) as required in 29 CFR Part 1926.62.
   i. Until an exposure assessment has been performed, treat the employee as if the employee were exposed above the PEL. Protective measures, as defined in 29 CFR Part 1926.26 shall be implemented.
   ii. If it is determined that a possibility of an employee exposure at or above the PEL exists, conduct monitoring which is representative of the exposure for each employee who may be exposed to lead in accordance to 29 CFR Part 1926.26.
   iii. If it is determined that no employee will be exposed to airborne concentrations of lead at or above the PEL, document such determination in accordance to 29 CFR Part 1926.26.

g. Implement construction management and work practice controls to reduce and maintain employee exposure to lead below the PEL and to minimize the potential release of airborne lead-containing material into the environment. Where such practices are not sufficient, provide the employee with the appropriate protective equipment that complies with regulatory requirements.
h. Controls to prevent airborne concentrations of lead containing material (LCM) to be released into the workplace and the environment include, but are not limited to the following:
    i. Adequately wet LCM during demolition or construction activities to minimize airborne dust.
    ii. Maintain surfaces as free as possible of accumulations of LCM.
    iii. Clean-up floor and other surfaces where potential LCM accumulates by vacuuming or other methods that minimize the likelihood of lead becoming airborne.
    iv. Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or equivalent methods have been determined not to be effective.
    v. For vacuuming methods, the vacuums shall be equipped with HEPA filters and used and emptied on a manner minimizing reentry of lead into the workplace or environment.
    vi. Compressed air shall not be used to remove lead from any surface unless used in conjunction with a ventilation system designed to contain the airborne dust created by the compressed air.

C.2.2.4 Disposal

a. If the debris generated via work activities is suspected to contain lead-based paint in sufficient quantities to be considered hazardous as defined in 40 CFR §261.2, the waste shall be further evaluated by the contractor performing the work in accordance to the appropriate testing methods to determine appropriate handling and disposal procedures.
b. Dispose of lead painted masonry or concrete at a WDNR- licensed sanitary landfill.

Containerize all lead paint removed from masonry or concrete and manage as hazardous waste. Stage containers in secure area. Off-site disposal will be provided by others. Coordinate the off-site disposal of hazardous building materials with the department's hazardous waste contractor: Veolia Environmental Services, Greg Holtzen, (262) 255-6655 Ext 72634.

C.2.2.5 Payment

Lead-based paint removal shall be incidental to other demolition activities. The department will not measure and pay separately for preparing submittals; removing all lead-based paint; erecting, maintaining and removing temporary enclosures; monitoring; properly disposing of LCM; reporting and furnishing all necessary documentation; and for furnishing all labor, equipment, tools, materials, and incidentals necessary to complete the work in accordance to the contract.

C.2.3 Hazardous Materials Removal

Mr. Steven Marcinkowski and Mr. Bruce Benoit performed a limited hazardous material assessment of the train shed structure located at 433 W. St. Paul Avenue, Milwaukee, Wisconsin on August 23, 2007. Lead-based paint (LBP) was identified at several locations within the structure as described in the report entitled "Pre-Renovation/Demolition Hazardous Material Assessment Lead-Based Paint Survey Report, Milwaukee Intermodal Station – Train Shed. 433 West St. Paul Avenue, Milwaukee, Wisconsin" prepared by Sigma Environmental Services, Inc. and dated September 2007.

C.2.3.1 Regulatory Requirements

a. Comply with all applicable rules, regulations, codes and ordinances of Local, State and Federal Authorities including but not limited to:
b. Local Authority - Abide by all local requirements which pertain to hazardous materials management and disposal exposure.
c. State Authority - Wisconsin Administrative Code:
   ILHR Chapter 32 Safety and Health Standards for Public Employees
   NR Chapter 488 Refrigerant Recovery from Salvaged or Dismantled Refrigeration Equipment
d. Federal Authority - Code of Federal Regulations:
   40 CFR Protection of the Environment
   29 CFR Labor; specifically including but not limited to:
      29 CFR Part 1926: Safety and Health Regulations for Construction, specifically including but not limited to:
         Subpart Z - Toxic and Hazardous Substances
e. WDNR Publication WA-651 2007, Pre-Demolition Environmental Checklist

C.2.3.2 Work Procedures

Prior to commencement of demolition, perform a walk-through inspection to indentify all hazardous materials that are required to be removed.

Properly remove all hazardous materials prior to demolition. Notify the owner and/or owner's Environmental Consultant immediately if any of the following that are not identified in Sigma's September 2007 reports are discovered during demolition activities:

Suspect radioactive containing devices (self-illuminating exit signs and smoke detectors);
Fire extinguishers (halons);
High Intensity Discharge light bulbs;
Fluorescent lighting ballasts;
CFC refrigeration devices;
Mercury containing devices;
LP tanks and their contents;
Electrical transformers and associated fluids;
Batteries

C.2.3.3 Disposal
Containerize all hazardous materials in containers provided by others and stage containers in secure area. Containers for hazardous building materials and off-site disposal will be provided by others. Coordinate the delivery of containers and the off-site disposal of hazardous building materials with the department's hazardous waste contractor: Veolia Environmental Services, Greg Holtzen, (262) 255-6655 Ext. 72634.

C.2.4 Temporary Shoring
Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

Strengthen or add new supports when required during progress of demolition.

C.3 Protection
C.3.1 Existing Facilities
Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Perform all removal operations that include the potential for falling debris on walkways, railroad tracks, or roadways under or adjacent to the structure during periods of time when these walkways, railroad tracks and roadways are closed to traffic. Coordinate temporarily closings with the owner for brief periods, removal work is limited to preliminary operations that have no possibility of creating falling debris and will not reduce the structural strength or stability of the structure or any element thereof, to a level that, in the judgment of the engineer, would constitute a hazard to the public. Prior to temporarily closings to public traffic to accommodate structure removal operations, have all necessary workers, materials, and equipment at the site as needed to immediately proceed with the removal work in an expeditious manner. While the walkways, railroad tracks and/or roadways are temporarily closed to traffic, perform work promptly, without interruption, until the walkways, railroads and/or roadway are reopened to public traffic.

C.3.1 Existing Utilities
a. Maintain utility services indicated to remain and protect them against damage during demolition operations.
b. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by owner and authorities having jurisdiction.
c. Provide temporary services during interruptions to existing utilities, as acceptable to owner and to authorities having jurisdiction.
d. Provide at least 72 hours notice to owner if shutdown of service is required during changeover.

C.3.3 Temporary Protection
a. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.
b. Protect existing site improvements, appurtenances, and landscaping to remain.

c. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
d. Provide protection to ensure safe passage of people around demolition area and to and from occupied portions of adjacent buildings and structures.
e. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to demolition operations.
f. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise from occupied portions of adjacent buildings.

C.4 Demolition, General

C.4.1 General

a. Demolish indicated existing structures completely. Use methods required to complete the work within limitations of governing regulations and as follows:
b. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
c. Maintain adequate ventilation when using cutting torches.
d. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

C.4 Engineering Surveys

Perform surveys as the work progresses to detect hazards that may result from building demolition activities.

C.5 Site Access and Temporary Controls

a. Conduct demolition and debris-removal operations to ensure minimum interference with railroad tracks, roads, streets, walks, walkways, and other adjacent occupied and used facilities.
b. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
c. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
d. All materials generated during demolition activities shall become the property of the contractor for salvage and/or off-site disposal by contractor.

C.5 Repairs

C.5.1 General

a. Promptly repair damage to adjacent construction caused by building demolition operations.
b. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

c. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

C.6 Recycling Demolished Materials

C.6.1 General

a. Separate recyclable demolished materials from other demolished materials to the maximum extent possible. Separate recyclable materials by type.
b. Provide containers or other storage method approved by engineer for controlling recyclable materials until they are removed from project site.
c. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
d. Stockpile materials away from demolition area. Do not store within drip line of remaining trees.
e. Transport recyclable materials off owner's property and legally dispose of them.

C.7 Disposal of Demolished Materials

C.7.1 General

a. Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain owner's property, remove demolished materials from project site and legally dispose of them in an EPA-approved landfill.
b. Do not allow demolished materials to accumulate on-site.
c. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C.7.2 Burning

Do not burn demolished materials.

C.7.3 Disposal

Transport demolished materials off owner's property and legally dispose of them.

C.8 Cleaning

Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

D Measurement

The department will measure Shed Demolition as a single lump sum unit of work for shed demolition, 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.0105.54	Shed Demolition	LS

Payment is full compensation for furnishing all demolition not noted in other specifications and pay items including the existing shed roof, trusses, columns, selective demolition of the existing building, fencing, walls, beams, utilities, pipes, conduits, and all other miscellaneous removals as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

117. Steam Pipe Demolition and Alterations, Item SPV.0105.55.

A Description
This special provision describes the demolition of the overhead Steam Pipe system.

B (Vacant)

C Construction
Construct in accordance to standard spec 204.

D Measurement
The department will measure Steam Pipe Demolition and Alterations as a single lump sum unit of work for steam pipe demolition and alterations, 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.0105.55	Steam Pipe Demolition and Alterations	LS

Payment is full compensation for furnishing all Steam Pipe Demolition as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

118. Concrete Demolition, Item SPV.0105.56.

A Description
A.1 General
This special provision includes the demolition and removal of concrete structures.

A.2 Submittals
A.2.1 Qualification Data
Qualification data for demolition firm

A.2.2 Proposed Environmental Protection, Dust Control and Noise Control Measures
Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

A.2.3 Schedule of Building Demolition Activities
Indicate the following:

a. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
b. Interruption of utility services.
c. Coordination for shutoff, capping, and continuation of utility services.
d. Locations of temporary protection and means of egress, including for other tenants affected by building demolition operations.
e. Coordination of owner's continuing occupancy of adjacent buildings and partial use of premises.

A.2.4 Inventory
After demolition is complete, submit a list of items that have been removed and salvaged.

A.2.5 Landfill Records
Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

A.3 Quality Assurance
A.3.1 Demolition Firm Qualifications
An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this project.

A.3.2 Regulatory Requirements
Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

A.3.3 Standards
Comply with ANSI A10.6 and NFPA 241.

A.3.4 Predemolition Conference
Conduct conference at project site a minimum of one week prior to beginning of demolition operations.

A.4 Project Conditions
owner will occupy another building immediately adjacent to demolition area. Conduct building demolition so owner's operations will not be disrupted.

Provide not less than 72 hours notice to owner of activities that will affect owner's operations.

Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.

Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction.

Storage or sale of removed items or materials on-site is not permitted.

A.5 Coordination
Arrange demolition schedule so as not to interfere with owner's and other tenants' on-site operations.

B (Vacant)

C Construction
C.1 Examination
Survey existing conditions and correlate with requirements indicated to determine extent of concrete demolition required.

Review project record documents of existing construction provided by the engineer. Owner does not guarantee that existing conditions are the same as those indicated in project record documents.

Inventory and record the condition of items to be removed and salvaged.

When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to engineer.

Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

Verify that hazardous materials have been remediated before proceeding with building demolition operations.

C.2 Preparation
C.2.1 Existing Utilities
Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

Owner will arrange to shut off indicated utilities when requested by contractor.

Arrange to shut off indicated utilities with utility companies.

If utility services are required to be removed, relocated, or abandoned, before proceeding with building demolition provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

C.2.2 Temporary Shoring
Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

Strengthen or add new supports when required during progress of demolition.

C.3 Protection
C.3.1 Existing Facilities
Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations.

C.3.2 Existing Utilities
Maintain utility services indicated to remain and protect them against damage during demolition operations.

Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by owner and authorities having jurisdiction.

Provide temporary services during interruptions to existing utilities, as acceptable to owner and to authorities having jurisdiction.

Provide at least 72 hours' notice to owner if shutdown of service is required during changeover.

C.3.3 Temporary Protection
Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.

Protect existing site improvements, appurtenances, and landscaping to remain.

Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

Provide protection to ensure safe passage of people around demolition area and to and from occupied portions of adjacent buildings and structures.

Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to demolition operations.

Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise from occupied portions of adjacent buildings.

C.4 Demoltion

C.4.1 General

Demolish indicated existing structures completely. Use methods required to complete the work within limitations of governing regulations and as follows:

a. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
b. Maintain adequate ventilation when using cutting torches.
c. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

C.4.2 Engineering Surveys

Perform surveys as the work progresses to detect hazards that may result from building demolition activities.

C.4.3 Site Access and Temporary Controls

Conduct demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C.4.4 Mechanical Demolition

C.4.4.1 Concrete

Cut concrete full depth at junctures with construction indicated to remain, using power-driven saw, then remove concrete between saw cuts.

C.4.4.2 Slabs-on-grade

Saw-cut perimeter of area to be demolished at junctures with construction indicated to remain, then break up and remove.

C.4.4.3 Below-Grade Construction

Demolish foundation walls and other below-grade construction that is within 5 feet (1.5 m) outside of footprint indicated for new construction. Abandon below-grade construction outside this area.

Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.

C.4.5 Existing Utilities
Demolish existing utilities and below-grade utility structures that are within 5 feet (1.5 m) outside of footprint indicated for new construction. Abandon utilities outside this area.

Fill abandoned utility structures with satisfactory soil materials.

C.4.6 Piping
Disconnect piping at unions, flanges, valves, or fittings.

C.4.7 Wiring Ducts
Disassemble into unit lengths and remove plug-in and disconnecting devices.

C.4.8 Fencing
Dismantle field connections without bending or damaging aluminum members. Do not use flame-cutting torches unless otherwise authorized by engineer.

C.4.9 Site Restoration
C.4.9.1 Below-Grade Areas
Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Compacted Backfill article.

C.4.9.2 Site Grading
Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

C.5 Repairs
C.5.1 General
Promptly repair damage to adjacent construction caused by building demolition operations.

Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

C.6 Recycling Demolished Materials
C.6.1 General
Separate recyclable demolished materials from other demolished materials to the maximum extent possible. Separate recyclable materials by type.

Provide containers or other storage method approved by engineer for controlling recyclable materials until they are removed from project site.

Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

Stockpile materials away from demolition area. Do not store within drip line of remaining trees.

Transport recyclable materials off owner's property and legally dispose of them.

C.7 Disposal of Demolished Materials

C.7.1 General

Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain owner's property, remove demolished materials from project site and legally dispose of them in an EPA-approved landfill.

Do not allow demolished materials to accumulate on-site.

Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C.7.2 Burning

Do not burn demolished materials.

C.7.3 Disposal

Transport demolished materials off owner's property and legally dispose of them.

C.8 Cleaning

Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

D Measurement

The department will measure Concrete Demolition as a single lump sum unit of work for concrete demolition, 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.0105.56	Concrete Demolition	LS

Payment is full compensation for furnishing all concrete demolition including foundations, walls, pedestals, platform canopies, precast facings, open screen walls, and all miscellaneous concrete removals as per the plans, details, schedules, and these special

provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

119. Remove Fire Protection Water Lines, Item SPV.0105.57.

A Description
This special provision describes the removal and abandonment of the existing fire protection sprinkler system mounted on tunnel ceiling.

B (Vacant)

C Construction
Valve off existing tunnel sprinkler system, and upon severing connection to building sprinkler system, permanently plug tunnel feed. Remove all ceiling mounted sprinklers and associated piping without damaging existing tunnel to remain. Fill mounting holes with mortar and strike flush with tunnel surface. Abandoned fire protection lines become property of contractor and must be properly disposed of as part of this bid item.

D Measurement
The department will measure Remove Fire Protection Water Lines as a single lump sum unit of work for removing fire protection water lines, acceptably removed.

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.57	Remove Fire Protection Water Lines	LS

Payment is full compensation for abandoning all watermain as per the plans, details, schedules, and these special provisions, including but not limited to cutting and removal of pipe and fittings and installing mechanical caps; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

120. Blower and Tunnel Vent Pipes Demolition and Alterations, Item SPV.0105.58.

A Description
A.1 General
This special provision describes the demolition and alterations of blower and vent pipes in the existing concrete tunnel.

A.2 Submittals
a. Qualification Data: For demolition firm.
b. Inventory: After building demolition is complete, submit a list of items that have been removed and salvaged.

A.3 Quality Assurance

a. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this project.
b. Standards: Comply with ANSI A10.6 and NFPA 241.
c. Predemoliton Conference: Conduct conference at project site to comply with requirements in Division 1 section "Project Management and Coordination."

B (Vacant)

C Construction

C.1 Examination

Survey existing conditions and correlate with requirements indicated to determine extent of building demolition required.

Review project record documents of existing construction provided by engineer. Owner does not guarantee that existing conditions are the same as those indicated in project record documents.

When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to engineer.

Verify that hazardous materials have been remediated before proceeding with building demolition operations.

C.2 Demolition, General

Demolish indicated existing blowers and venting pipes completely. Use methods required to complete the work within limitations of governing regulations and as follows:

a. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
b. Maintain adequate ventilation when using cutting torches.
c. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

C.3 Mechanical Demolition

Remove equipment intact when permitted by authorities having jurisdiction.

Disconnect equipment at nearest fitting connection to services, complete with service valves. Remove as whole units, complete with controls.

C.4 Repairs

Promptly repair damage to adjacent construction caused by building demolition operations.

Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

C.5 Disposal of Demolished Materials
Except for items or materials indicated to be [recycled,] reused, salvaged, reinstalled, or otherwise indicated to remain owner's property, remove demolished materials from project site and legally dispose of them in an EPA-approved landfill.

Do not allow demolished materials to accumulate on-site.

Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

Transport demolished materials off owner's property and legally dispose of them.

C.6 Cleaning
Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before demolition operations began.

D Measurement
The department will measure Blower and Tunnel Vent Pipes Demolition and Alterations as a single lump sum unit of work for blower and tunnel vent pipes demolition and alterations, 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.0105.58	Blower and Tunnel Vent Pipes Demolition and Alterations	LS

Payment is full compensation for furnishing and installing all tunnel demolition and alterations as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

121. Sawing, Item SPV.0105.59.

A Description
This special provision describes sawing concrete or asphalt including pavement, curb and gutter, driveways, sidewalks, and similar work.

B (Vacant)

C Construction
Construct in accordance to standard spec 690.3.

D Measurement
The department will measure Sawing as a single lump sum unit of work for sawing, 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.0105.59	Sawing	LS

Payment is full compensation for furnishing all sawing as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

122. Platform Demolition, Item SPV.0105.60.

A Description
This special provision describes the demolition of the existing concrete platform, concrete wall and fencing, asphalt pavement, canopy, and utility poles as shown on the site demolition plan.

B (Vacant)

C Construction
Construct in accordance to standard spec 204.3. Contractor is responsible for the protection of existing buildings, structures, and pavement to remain in place. When removing concrete or asphalt, full depth saw cuts are required as defined in the sawing bid item.

C.1 Lead-Based Paint
Remove lead-based paint prior to demolition of the existing concrete platforms if concrete material from the existing platforms will be recycled. Complete all work under this item in accordance to National Emission Standards for Hazardous Air Pollutants (NESHAP) and the Wisconsin Administrative Code NR 427. The locations of known lead-based paint are delineated in the report entitled "Pre-Renovation/Demolition Lead-Based Paint Survey Report, Milwaukee Intermodal Station – Train Shed. 433 W. St. Paul Avenue, Milwaukee, Wisconsin" prepared by Sigma Environmental Services, Inc. and dated September 2007. Submit documentation of the lead-based paint removal to the engineer and the environmental consultant. Conduct all activities in a Lead-Safe manner in accordance to OSHA 29 CFR 1926.62 and other applicable regulations.

D Measurement
The department will measure Platform Demolition as a single lump sum unit of work for platform demolition, 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.0105.60	Platform Demolition	LS

Payment is full compensation for furnishing all platform demolition as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

123. Handrail Removal, Item SPV.0105.61.

A Description

A.1 General

This special provision includes the removal of handrail structures.

A.2 Submittals

Qualification Data: For demolition firm.

A.3 Coordination

Arrange demolition schedule so as not to interfere with owner's and other tenants' on-site operations.

B (Vacant)

C Construction

C.1 Demolition

C.1.1 General

Demolish indicated existing handrails completely. Use methods required to complete the work within limitations of governing regulations and as follows:

a. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
b. Maintain adequate ventilation when using cutting torches.

C.1.2 Site Access and Temporary Controls

Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C.2 Mechanical Demolition
Proceed with demolition of handrail members systematically, from higher to lower level.

C.2.1 Structural Members
Dismantle field connections without bending or damaging structural members. Do not use flame-cutting torches unless otherwise authorized by engineer.

C.3 Disposal of Demolished Materials
C.3.1 General
Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain owner's property, remove demolished materials from project site and legally dispose of them in an EPA-approved landfill.

Do not allow demolished materials to accumulate on-site.

Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C.3.2 Disposal
Transport demolished materials off owner's property and legally dispose of them.

D Measurement
The department will measure Handrail Removal as a single lump sum unit of work for handrail removal, 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.0105.61	Handrail Removal	LS

Payment is full compensation for furnishing all removal of handrails as per the plans, details, schedules, and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

123. Asphalt Placement and Restoration, Item SPV. 0105.62.

A Description
This special provision describes constructing HMA pavement Type E-1 in areas disturbed behind the train platform wall and at the at-grade crossings between the railroad tracks identified in the plans.

B Materials
Materials shall be in accordance to standard specs 455 and 460.

C Construction
Construct in accordance to standard spec 460.3. Asphalt placement and restoration shall be constructed of two lifts of type E-1 pavement as follows:

1.75" of 12.5 mm HMA pavement Type E-1,
Performance Grade PG58-28, as the Upper Layer

2.25" of 19.0 mm HMA pavement Type E-1,
Performance Grade PG58-28, as the Lower Layer

D Measurement
The department will measure Asphalt Placement and Restoration as a single lump sum unit for asphalt placement and restoration, 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.0105.62	Asphalt Placement and Restoration	LS

Payment is full compensation for furnishing all asphalt restoration as per the plans, details, schedules and these special provisions; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the contract work.

Density incentive and disincentive payment adjustments will not be made for this pay item.

124. Column Foundation Monitoring, Item SPV.0105.63.

A Description
This special provision describes preparing and installing bench marks on existing and reconstructed concrete column foundations for the purpose of monitoring foundation settlement, and monitoring foundation settlement in accordance to the details shown on the plans and as hereinafter provided.

B (Vacant)

C Construction
Monitor settlement of existing column foundations throughout the construction project and afterward as noted below.

a. Set or define benchmark to which all measurements shall be referenced to. Benchmark shall be in an area that will not be disturbed during the construction process. Set additional benchmarks as needed.

b. Take initial readings of all roof support column base plates before construction begins.
c. As each existing footing is exposed record top of footing elevations.
d. As new column pedestals are built set and record new benchmarks at each footing.
e. Check base plate, footing and benchmark elevations each time pile driving is complete for a stage of work.
f. After all support columns for new mezzanine and roof are erected check and record benchmark elecvatons at all shed canopy columns.
g. Record column benchmarks every 30 days until 90 days after the project is open to public use.
h. Prepare and submit report of all recordings.

Take all necessary precautions to ensure that temporary benchmarks are not displaced or misaligned.

If any observed cumulative settlement of any column foundation exceeds ½", immediately notify the department.

D Measurement

The department will measure Column Foundation Monitoring as a single lump sum unit of work for column foundation monitoring, 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.0105.63	Column Foundation Monitoring	LS

Payment is full compensation for furnishing and placing benchmarks, monitoring benchmark elevations, recording and reporting, and all and all labor tools, equipment, and incidentals necessary to complete the contract work.

125. Aluminum Windows, Section 08 52 00, Item SPV.0105. 64.

A Description

A.1 General

This special provision describes the labor and materials for the fabrication, furnishing and installation of aluminum windows on nine (9) windows of the Third Level Conference Room in the Station Building to remedy acoustical conditions, complete with extruded aluminum framing, glass, hardware, blocking, sealants, painting and all wall, ceiling and surface removal and repair work and materials as well as all accessories and all required components as shown on the architectural drawings, inferable there from and specified herein for a complete and finished installation.

The work specified in this section includes:

A.2 Related Work Specified Elsewhere:

a. Section 07 92 00 Sealants
b. Section 09 21 00 Gypsum Board Assemblies
c. Section 09 91 00 Painting
d. Acoustical Tile Ceiling.(Specification Not Included)

A.3 Quality Assurance:

a. Single Contract Responsibility: Subcontract the aluminum windows to a single firm, hereinafter referred to as the window contractor, who has specialized for a period of not less than 5 years in the installation of window wall systems equivalent to those specified.
b. Coordinate the window installation with Aluminum Windows on the south side of the existing Station Building with the occupants who will seek to maintain full use of the facility.
c. Comply with Standard Specifications for Aluminum and Aluminum Alloy sheet, plate and extruded bars, rods, tubes –ASTM B 209 and ASTM B 221.

A.4 Submittals

a. Contractor shall submit shop drawings, showing the construction of all parts of the work, including metal thicknesses, methods of joining, details of field connections and anchorage, fastening and sealing methods and metal finishes.
b. Relationship to other work shall be clearly indicated. No work shall proceed with fabrication until shop drawings have been reviewed and accepted by the architect.
c. Contractor shall submit finished color samples of frame, glass and glazing gaskets and any visible fasteners.
d. Provide test reports, structural calculations, warranties and manufacturer's maintenance manual prior to the completion of the work

A.5 Performance and Testing Requirements

a. Window wall framing system shall be designed to provide for thermal movement of all component materials resulting from surface temperatures ranging from + 120 degree F to - 40 degrees F without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects
b. Structural Performance: Provide systems, including anchorage, capable of withstanding. 15.0 psf positive and 15.0 psf negative design wind pressure normal to the plane of the wall.
c. Main-Framing-Member Deflection: Limited to 1/175 of clear span or 1/4 inch, whichever is smaller.
    i. Structural Testing: Systems tested according to ASTM E 330 at 150 percent of inward and outward wind-load design pressures do not evidence material failures, structural distress, deflection failures, or permanent deformation of main framing members exceeding 0.2 percent of clear span.

A.6 Product Handling:

a. Deliver fabricated window frame units to the project site completely identified in accordance to the erection diagrams.
b. Store in accordance to the manufacturer's instructions above grade, on dunnage properly protected from weather and construction activity.

A.7 Warranties:

a. The manufacturer shall warrant the window walls for 3 years the satisfactory performance of the entire installation, including anchorage, with any deficiencies during the warranty period corrected by the manufacturer at his expense.
b. The manufacturer shall warrant the fluoropolymer painted finish for20 years

B Materials

B.1 Basis for Design Product:

The design for the windows is based on:

a. Series 7225 Non-Thermal Fixed Sealair Architectural Windows with dual glazing by Kawneer Co, Inc. Norcross GA 877 767 9107

Subject to compliance with the requirements, details and these specifications comparable product by one of the following will be given consideration:

a. Wausau Window and Wall Systems, Wausau, WI (877) 678-2983
b. Tubelite Inc. Walker, MI (800) 866-2227

B.2 Aluminum Framework:

a. Aluminum Extrusions , alloy 6063 – T5 or 7063 - T6 in accordance to ASTM B 209 sheet and ASTM B 221 extrusions. Sizes , shapes and profiles as indicated on the Contract Drawings.

B.3 Clear Glass:

a. All glass shall be SIGMA classification, consisting of tempered Plate or Float Glass or laminated units necessitating a Polyvinyl butyl interlayer, Type I Class, quality Q3 to meet the requirements of ANSI Z97.1 - 1984 and CPSC 16 CFR 1201.
    i. Locate tong marks along an edge which will be concealed in the glazing system.
    ii. Tempered glass to increase the flexural strength 4 to 5 times before treatment with the probability of breakage due to anticipated thermal and wind loads not to exceed 8/1000 for vertical lights.
    iii. Laminated glass units shall be guaranteed for a period of 10 years not to develop material obstruction of vision, as a result of dust, or film formation on the internal glass surfaces caused by the failure lamination film.
b. Glazing Strips shall be roll-in wedge high quality extruded elastomeric, EPDM both inside and outside. Color: Black
c. Setting Blocks: Extruded Type II silicone rubber , hardness ASTM D2240 Type A 80 +/- 5 durometer.

d. Sealants and Joint Fillers: For joints at exterior perimeter of systems as specified in Division 7 Section 07 92 00 – Joint Sealants.
e. Interior Acoustical Sealant: Equivalent to "QuietZone Acuostic Sealant" By Owens Corning Insulating Systems, Toledo OH (800) GET PINK.
f. Interior Sound Absorptive Panels and Adhesive: Equivalent to "Sonofiber ™ and "Foamtac" Spray Adhesive by Auralex Acoustics, Inc., Indianapolis, IN (317) 842 2600.
g. Fasteners and Accessories: Compatible with adjacent materials, corrosion-resistant, nonstaining, and nonbleeding. Use concealed fasteners.

B.4 Finish:

a. Complying with NAAMMs "Metal Finishing Manual fort Architectural and Metal Products" Fluoropolymer Coating, 70% PVDF conforming to AAMA 605-02-92 in a "white" color to be selected by the architect.

C Construction

C.1 Fabrication

a. Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide sub-frames and reinforcing of types indicated or, if not indicated, as required for a complete system.
b. All exposed work shall be carefully matched to produce continuity of line and design with all joints. Raw edges shall not be visible.
c. Frame dimensions shall be as indicated on the Architectural Drawings and verified by field measurement.
d. All exposed surfaces to be fine satin finish prior to application of material finish to eliminate extrusion die marks and fabrication marks.
e. Finish: Chemically cleaned for organic coating fluoropolymer system
f. Factory assemble components to greatest extent possible.

C.2 Installation

a. Use only skilled tradesman to implement the work in full compliance with the accepted shop drawings and specifications.
b. Isolate aluminum surfaces in contact with incompatible metal or corrosive substrates, by painting contact surfaces with bituminous coating or primer or by applying sealant or tape recommended by the manufacturer.
c. Revise existing ceiling tile area at the head of each window and install required wood blocking as detailed.
d. Install absorptive acoustic material in the airspace between the existing and new windows.
e. Anchor window wall system to maintain permanent position when subjected to thermal movement, building deflections, and wind loads.
f. Install framing components true in alignment to the following tolerances:
    i. Variation from plane: Limit to 1/8" in 12 ft.
    ii. Alignment: For surfaces abutting in line, limit to 1/32"; for surfaces meeting at corners, limit offset to 1/32".

iii. Diagonal Measurements: Limit difference between diagonal measurements to 1/8".

g. Standard factory glazing to meet ASTM C 1036-91
h. Apply sealing materials to provide both an exterior weather tight and interior air tight, installation at all joints and intersections in strict accordance with manufacturer's printed instruction and only by mechanics trained and experienced in their use.
i. Finish and paint new interior window perimeters in compliance with Specification Section 09 91 00.

C.3 Protection and Cleaning

a. Protect window and wall paint finish and ceiling finish from damage during construction with temporary protective coverings and restore any finish that may have been damaged, leaving no evidence of repair.
b. When most of the construction has been completed, remove the protective coatings on the window wall system and clean the aluminum and glass as recommended by the manufacturer for the type of finish.

D Measurement

The department will measure Aluminum Windows as a single lump sum unit of work, acceptably completed.

E Payment

The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.64	Aluminum Windows	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

126. Ballast Mat, Item SPV.0105. 65.

A Description

This special provision describes the labor and materials for the fabrication, furnishing and installation of a ballast mat on top of the rehabilitated pedestrian underpass as well as all accessories and all required components as shown on the structural drawings, inferable there from and specified herein for a complete and finished installation.

B Materials

Ballast mat shall be as manufactured by the following:

a. Type 4 Ballast Mat by Armsted RPS, 8400 W. 110th St, Suite 300, Overland Park, KS 66210. (913) 345-4807.
b. Type USM DN1019 Subballast Mat by Getzner USA, Inc, 8720 Red Oak Boulevard, Suite 528, Charlotte, NC, 28217. (704) 966-2132.
c. Approved equal.

All materials incidental to the ballast mat shall be as recommended by the selected manufacturer.

Order the ballast mat materials as early as possible to prevent any impact on the project schedule.

C Construction

C.1 General

Handle, ship, store, and install ballast mat accoording to the manufacturer's instructions.

Securely store and protect ballast mat and all materials required for the installation and take necessary precautions for handling and delivery to the job site. Damaged materials will not be accepted for installation and must be replaced at no cost to the department.

Manufacturer's technical representative shall be on site to oversee installation of the ballast mat. Submit a proposed procedure for storage, handling, transport and installation of the ballast mat materials to the department. Submit detailed shop and installation drawings showing the location of all joints in the ballast mat.

C.2 Installation

Ballast mat shall be installed directly on the waterproofed concrete deck cleaned of all debris, dust, oil, grease, water, or other foreign material detrimental to performance. Remove rough or uneven areas until the surface is acceptable and re-waterproof as required. Deck panel joints, corners, and other recesses shall be inspected carefully prior to installing the mats.

Install the mats in accordance to the manufacturer's recommendations and instructions. Overlap the mat sections as required by the instructions.

Cut ends of the ballast mat rolls square and in a neat straight line. Seal the joints as specified by the ballast mat manufacturer.

Exercise extreme care to prevent intrusion of silt and debris into the void spaces of the ballast mat. Protect the joints and place protection strips over the edges of the ballast mat as soon as the mat is installed. At no time shall water, silt, or debris be allowed to enter into the newly installed ballast mat from the adjacent tracks or other sources. If necessary, install temporary seals along the open edges of the mat to prevent such intrusion. Remove ballast mats contaminated with silt and debris, clean and reinstall or replace with new materials at no cost to the department.

Protect ballast mat from damage between the time that the mat is installed and ballast is placed on the mat. Coordinate with the Railroad to have ballast placed on the mat as soon as possible after the mat installation is complete.

C.3 Certification
Supply documentation to verify that field installation meets all manufacturer recommendations.

D Measurement
The department will measure Ballast Mat as a single lump sum unit of work, acceptably completed.

E Payment
The department will pay a lump sum price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.65	Ballast Mat	LS

Payment is the full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for a complete and fully performing system in compliance with this contract specification and the contract drawings, details and schedules.

127. Direct Landfill, Item SPV.0195.01.

A Description
A.1 General
This special provision describes excavating, segregating, loading, hauling, and direct landfill disposal of contaminated material at a WDNR-approved landfill. The closest WDNR-approved landfills are:

Metro RDF
10712 S. 124th Street
Franklin, WI 53132

Veolia Emerald Park
W124 S10629 S. 124th St
Muskego, WI 53150

Orchard Ridge RDF
W124 N9355 Boundary Road
Menomonee Falls, WI 53051

Perform this work in accordance to standard spec 205 and with pertinent parts of Chapters NR 700-754 of the Wisconsin Administrative Code, as supplemented herein. Per NR 718.07, a solid waste collection and transportation service-operating license is required under NR 502.06 for each vehicle used to transport contaminated soil.

A.2 Notice to the Contractor – Contaminated Material Locations
The department and others have completed testing for soil and groundwater contamination at locations within this project where excavation is required. Results indicate that fill material impacted with petroleum and metals is present where excavation is required. Fill materials generally containing petroleum-contaminated soil with lesser

amounts of railroad ballast and other debris shall be treated and disposed at a WDNR-approved bioremediation facility. Fill materials with significant amounts of railroad ballast and other debris shall be direct landfilled according to this article.

It is anticipated that no active groundwater monitoring wells will be encountered during construction. If active groundwater monitoring wells are encountered during construction, notify the engineer and protect the wells to maintain their integrity. The environmental consultant will determine if monitoring wells need to be maintained. Adjust monitoring wells that need to be maintained and do not conflict with structures or curb and gutter to be flush with the final grade. Coordinate with the environmental consultant the abandonment or adjustment of wells that conflict with the previously mentioned items and wells that are not required to be maintained.

The excavation management plan for this project has been designed to minimize the off-site disposal of contaminated material. The excavation management plan, including these special provisions, has been developed in cooperation with the WDNR. The WDNR concurrence letter is on file at the Wisconsin Department of Transportation. For further information regarding previous investigation and remediation activities at these sites contact:

Consultant:	TRC
Address:	708 Heartland Trail, Suite 3000, Madison, WI 53717
Contact:	Dan Haak
Phone:	(608) 826-3628
Fax:	(608) 826-3941

A.3 Coordination

Coordinate work under this contract with the environment consultant retained by the department's BEES:

Consultant:	TRC
Address:	708 Heartland Trail, Suite 3000, Madison, WI 53717
Contact:	Dan Haak
Phone:	(608) 826-3628
Fax:	(608) 826-3941

The role of the environmental consultant will be limited to:

a. Determining the locations and limits of contaminated material to be excavated based on analytical results from previous investigations, visual observations, and field screening of material that is excavated;
b. Identifying contaminated material to be hauled to the landfill;
c. Documenting that activities associated with management of contaminated material are in conformance with the contaminated material management methods for this project as specified herein; and
d. Obtaining the necessary approvals for disposal of contaminated material from the landfill.

The contractor shall provide at least a 14-calendar day notice of the preconstruction conference date to the environmental consultant. At the preconstruction conference, provide a schedule for all excavation activities in the contaminated areas specified above to the environmental consultant. Identify the WDNR approved landfill that will be used for direct landfill disposal of contaminated materials, and provide this information to the environmental consultant no later than 30 calendar days prior to commencement of excavation in the contaminated areas or at the preconstruction conference, whichever comes first.

The contractor shall coordinate with the environmental consultant to ensure that the environmental consultant has opportunity to be present during excavation in the contaminated areas. Notify the environmental consultant at least three working days prior to commencement of excavation activities in the contaminated areas. Perform excavation work in this area on a continuous basis until excavation work is completed. The environmental consultant will be responsible for obtaining the necessary approvals for disposal of contaminated materials from the landfill. Do not transport contaminated material offsite without prior approval from the environmental consultant.

A.4 Health and Safety Requirements
Supplement standard spec 107.1 with the following:

During excavation activities, expect to encounter soil contaminated with petroleum and metals. Site workers taking part in activities that will result in the reasonable probability of exposure to safety and health hazards associated with hazardous materials shall have completed health and safety training that meets the Occupational Safety and Health Administration (OSHA) requirements for Hazardous Waste Operations and Emergency Response (HAZWOPER), as provided in 29 CFR 1910.120.

Prepare a site-specific Health and Safety Plan, and develop, delineate and enforce the health and safety exclusion zones for each contaminated site location as required by 29 CFR 1910.120. Submit the site-specific health and safety plan and written documentation of up-to-date OSHA training to the engineer prior to the start of work.

B (Vacant)

C Construction
Supplement standard spec 205.3 with the following:

Control operations in the contaminated areas to minimize the quantity of contaminated material excavated.

The environmental consultant will periodically evaluate material excavated from the contaminated areas. The environmental consultant will evaluate excavated soil based on field screening results, visual observations, and soil analytical results from previous environmental investigations. Assist the environmental consultant in collecting soil

samples for evaluation using excavation equipment. The sampling frequency shall be a maximum of one sample for every 15 cubic yards excavated.

On the basis of the results of such field-screening, the material will be designated for disposal as follows:

a. Excavation Common consisting of clean soil and/or clean construction and demolition fill (such as clean soil, boulders, concrete, reinforced concrete, bituminous pavement, bricks, building stone, and unpainted or untreated wood), which under NR 500.08 are exempt materials, or
b. Low-level contaminated material for reuse as fill within the construction limits, or
c. Contaminated soil for off-site treatment and disposal at the WDNR-licensed bioremediation facility, or
d. Contaminated material for off-site direct landfill disposal at the WDNR-licensed landfill, or
e. Potentially contaminated for temporary stockpiling and additional characterization prior to disposal

Some material may require additional characterization prior to disposal. Provide for the temporary stockpiling of up to 100 cubic yards of contaminated soil on-site that require additional characterization. Construct and maintain a temporary stockpile of the material in accordance to NR 718.05(3), including, but not limited to, placement of the contaminated soil/fill material on an impervious surface and covering the stockpile with impervious material to prevent infiltration of precipitation. The department's environmental consultant will collect representative samples of the stockpiled material, laboratory-analyze the samples, and advise the contractor, within 10 business days of the construction of the stockpile, of disposal requirements. The stockpiled material shall be disposed either at the WDNR-licensed disposal facility by the contractor or, if characterized as hazardous waste, by the department. As an alternative to temporarily stockpiling contaminated soil/fill material that requires additional characterization, the contractor has the option of suspending excavation in those areas where such soil is encountered until such time as characterization is completed.

Directly load and haul materials designated by the environmental consultant for offsite disposal to the WDNR-approved landfill. Use loading and hauling practices that are appropriate to prevent any spills or releases of contaminated materials or residues. Prior to transport, sufficiently dewater soils designated for off-site treatment and disposal so as not to contain free liquids.

Based on the depth of groundwater (greater than 7 feet) reported in previous investigations and limited excavations (less than 4 feet) it is not anticipated that significant dewatering will be required. However, if dewatering is required, it shall, with pre-approval by the Milwaukee Metropolitan Sewerage District (MMSD), be discharged to the sanitary sewer. Contact MMSD at (414) 272-5100 prior to discharge of contaminated groundwater to the sanitary sewer. Furnish, install, operate, maintain, disassemble, and remove treatment equipment necessary to comply with MMSD requirements. Ensure continuous dewatering and excavation safety at all times. Provide,

operate, and maintain adequate pumping equipment and drainage and disposal facilities. Notify the engineer of any dewatering activities, and obtain any permits necessary to discharge water. Provide copies of such permits to the engineer. Meet any requirements and pay any costs for obtaining and complying with such permit use. Follow all applicable legislative statutes, judiciary decisions, and regulations of the State of Wisconsin.

D Measurement

The department will measure Direct Landfill in tons of contaminated material accepted by the landfill as documented by weight tickets generated by the landfill.

E Payment

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

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0195.01	Direct Landfill	Ton

Payment is full compensation for excavating, segregating, loading, hauling, and direct landfill of contaminated material; obtaining solid waste collection and transportation service operating licenses; assisting in the collection soil samples for field evaluation; temporary stockpiling of materials, if necessary; dewatering of soils prior to transport, if necessary; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

ADDITIONAL SPECIAL PROVISION 3
DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

1. Description

General

a. The disadvantaged business enterprise (DBE) requirements of 49 CFR Part 26 apply to this contract. The department's DBE goal is shown on the cover of the bidding proposal. The contractor can meet the specified contract DBE goal by procuring services or materials from a DBE or by subcontracting work to a DBE. The department calculates the DBE participation as the dollar value of DBE participation included in the bid expressed as a percentage of the total contract bid amount.

b. Under the contract, the contractor agrees to provide the assistance to participating DBE's in the following areas:

   i. Produce accurate and complete quotes.
   ii. Understand highway plans applicable to their work.
   iii. Understand specifications and contract requirements applicable to their work.
   iv. Understand contracting reporting requirements.

c. The department encourages the contractor to assist and develop DBE firms to become fully knowledgeable contractors to successfully perform on its contracts.

d. For information on the disadvantaged business program, visit the department's Civil Rights and Compliance Section website at:

   http://www.dot.wisconsin.gov/business/engrserv/dbe-main.htm

2. Definitions

a. Interpret these terms, used throughout this additional special provision, as follows:

   i. **Bid Percentage:** The DBE percentage indicated in the bidding proposal at the time of bid.
   ii. **DBE:** A disadvantaged business enterprise (DBE) certified as a DBE by the department and included on the department's list of certified DBE's who are determined to be ready, willing and able.
   iii. **DBE goal:** The amount of DBE participation expected in the contract as shown on the cover of the Highway Work Proposal.
   iv. **Discretionary Goal:** A contractor assigned DBE goal, typically abbreviated as “Disc” on the cover of the Highway Work Proposal, which is enforced as committed.
   v. **Manufacturer:** A firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract.
   vi. **Supplier:** A firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment required under the contract are bought, kept in stock, and regularly sold or leased to the public.
   vii. **Voluntary Achievement:** The amount of DBE participation achieved and reported in the contract in excess of the assigned goal.

3. DBE Percentage Required at Bid Submission

Indicate the bid percentage (i.e. 0% through 100%) of DBE participation on the completed bidding proposal, including projects with discretionary goals. For electronic submittals, show the percentage in the miscellaneous data folder, Item 3, DBE Percent. For paper submittals, show the percentage on the sheet included after the schedule of items. By submission of the bid, the bidder contractually commits to DBE participation at or above the bid percentage, or certifies that they have utilized

comprehensive good faith efforts to solicit and utilize DBE firms to meet the DBE participation requirements of this contract proposal, and that the bid percentage is reflective of these good faith efforts. If the bidder does not indicate the bid percentage of DBE participation on the completed bidding proposal, the department will consider the bid irregular and may reject the bid.

4. Department's DBE Evaluation Process

a. Documentation Submittal

Within 10 business days after the notification of contract award, the contractor is to identify, by name, the DBE firms whose utilization is intended to satisfy this provision, the items of work of the DBE subcontract or supply agreement and the dollar value of those items of work by completing the Commitment to Subcontract to DBE Form [DT1506] and all necessary attachment A forms, as well as, Good Faith Waiver Form [DT1202] and supporting documentation as necessary. If the contractor fails to furnish the required forms within the specified time, the department may cancel the award. Delay in fulfilling this requirement is not a cause for extension of the contract time and shall not be used as a tool to delay execution.

i. Bidder Meets DBE Goal

If the bidder indicates that the contract DBE goal is met, after award and before execution, the department will evaluate the Commitment to Subcontract to DBE Form DT1506 and attachment A(s) to verify the actual DBE percentage achieved. If the DBE commitment is verified, the contract is eligible for execution with respect to the DBE commitment.

ii. Bidder Does Not Meet DBE Goal

(1) If the bidder indicates a bid percentage on the Commitment to Subcontract to DBE Form [DT1506] that does not meet the contract DBE goal, the bidder must submit a Good Faith Waiver Form [DT1202] and supporting documentation. After award and before execution, the department will evaluate the bidder's DBE commitment and consider the bidder's good faith waiver request.

(2) The department will review the bidder's good faith waiver request and notify the bidder of one of the following:

a. If the department grants a good faith waiver, the bid is eligible for contract execution with respect to DBE commitment.

b. If the department rejects the good faith waiver request, the department may declare the bid ineligible for execution. The department will provide a written explanation of why the good faith waiver request was rejected. The bidder may appeal the department's rejection as allowed under 7 a. & b.

5. Department's Criteria for Good Faith Effort

The Code of Federal Regulations {CFR}, 49 CFR Part 26-Appendix A, is the guiding regulation concerning good faith efforts. However, the federal regulations do not define “good faith” but states that bidder must actively and aggressively attempt to meet the goal. The federal regulations are general and do not include every factor or effort that can be considered. As a result, each state must establish its own processes and consider the factors established in its own process when making a determination of good faith.

a. The department will only grant a good faith waiver if the bidder has made the effort, given the relevant circumstances under the contract that a bidder actively and aggressively seeking to meet the goal would make. The department will evaluate the bidder's good faith effort to determine whether a good faith waiver will be granted. The bidder must demonstrate, on the DT1202 that they have aggressively solicited DBE participation in an attempt to meet the contract DBE goal and attaining the stated DBE goal is not feasible.

b. The department, in conjunction with industry stakeholders, has developed the following guidance for contractor good faith effort. The guidance and the attached appendices provide a framework for the actions required by all parties in the processing and evaluation of bidder's total efforts to achieve the project specific DBE goal prior to the bid letting date.

c. Prime Contractors should:

i. Document all efforts and decisions made toward achieving the DBE goal on the contract. The bidder should use the Civil Rights & Compliance System [CRCS] and related WisDOT-approved DBE outreach tools, including the Bid Express Small Business Network, to foster DBE participation on all applicable contracts.

ii. Request quotes by identifying potential items to subcontract and solicit. Prime contractors are strongly encouraged to include in their initial contacts a single page including a detailed list of items for which they are accepting quotes, by project, within a letting. *See attached sample entitled "Sample Contractor Solicitation Letter" in Appendix A*. Prime contractors should also indicate a willingness to accept quotes in areas they are planning to perform themselves, ***as required by federal rules***. In some cases, it might be appropriate to use DBE's to do work in a prime contractor's area of specialization.

(1) Solicit quotes through all reasonable and available means from certified DBE firms who match 'possible items to subcontract' and send copies to DBESS office, highlighting areas in which you are seeking quotes. Email is acceptable.

(2) SBN is the preferred outreach tool. https://www.bidx.com/wi/main. Other acceptable means include postal mail, email, fax, phone call.

a. Primes must ask DBE firms for a response in their solicitations. See *Sample Contractors Solicitation Letter* in Appendix. This letter can be included as an attachment to the SBN sub-quote request.

b. Solicit quotes at least 10 calendar days prior to the letting date {ideally two Fridays before the letting} to allow DBE firms sufficient time to respond. Prime contractors should contact DBE firms early, asking them if they need help in putting together a quote, or helping to arrange for equipment needs, or solve other problems.

(3) Second solicitation should take place within 5 days

a. An email solicitation is highly recommended for this second solicitation

(4) Upon request, provide interested DBE firms with adequate information about plans, specifications and the requirements of the contract by letter, information session, email, phone call and/or referral.

(5) When potential exists, advise interested DBE firms on how to obtain bonding, line of credit or insurance as may be requested.

(6) Document DBE firm's interest in quoting by taking appropriate steps to follow up initial solicitation with:

a. Email to all prospective DBE firms in relevant work areas
b. Phone call log to DBE firms who express interest via written response or call.
c. Fax/letter confirmation
d. Copy of the DBE quotes
e. Signed copy of Bid Express SBN Record of Subcontractor Outreach Effort.

d. Evaluate DBE quotes as documentation is critical if the prime does not utilize the DBE firm's quote for any reason.

i. Evaluate DBE firm's capability to perform 'possible items to subcontract' using legitimate reasons, including but not limited to, ***a discussion with the DBE firm*** regarding its

capabilities prior to the bid letting. If lack of capacity is your reason for not utilizing the DBE quote, you are required to contact the DBE directly regarding their ability to perform the work indicated in the UCP directory as their work area [NAICS code]; only the work area and/or NAICS code listed in the UCP directory will be counted for DBE credit. Documentation of the conversation is required.

ii. In striving to meet a DBE conscious contract goal, prime contractors are expected to use DBE quotes that are responsive and reasonable. This includes DBE quotes that are not the low quote.

iii. **Special Circumstance:** Evaluation of DBE quotes with tied bid items. "Tied quotes are the condition in which a subcontractor submits quotes including multiple areas of expertise across multiple work areas noting that the items and price are tied. Typically this type of quoting represents a cost saving to the prime but is not clearly stated as a discount; tied quotes are usually presented as 'all or none' quote to the prime." When non-DBE subcontractors submit tied bid items in their quotes to the prime, the DBE firms' quote may seem not competitive. In such a case, the following steps are taken in comparing the relevant quotes. These are qualitative examples.

(1) Compare bid items common to both quotes, noting the reasonableness in the price comparison.

(2) Review quotes from other firms for the bid items not quoted by the DBE firm to see if combining both can provide the same competitive advantage that the tied bid items offered.

e. After notification of contract award, submit **'Commitment to Subcontract'** form within the time period specified in the contract.

i. Provide the following information along with department form DT1202:

(1) The names, addresses, e-mail addresses, telephone numbers of DBE's contacted. The dates of both initial and follow-up contact. A printed copy of SBN solicitation is acceptable.

(2) A description of information provided to the DBE's regarding the plans, specifications, and estimated quantities for portions of the work to be performed by that DBE.

(3) Photocopies or electronic copies of all written solicitations to DBE's.

(4) Documentation of each quote received from a DBE and, if rejected, the reason for that rejection.

(5) Bidder attendance at any pre-solicitation or pre-bid meetings the department held to inform DBE's of participation opportunities available on the project.

f. The department's DBE Support Services Office is available by phone, email or in writing to request assistance in meeting the DBE goal:

DBE Support Services Office
6150 Fond du Lac Ave.
Milwaukee, WI 53218
Phone: 414-438-4583 / 608-266-6961
Fax: 414-438-5392
E-mail: DOTDBESupportServices@dot.wi.gov

6. Bidder's Appeal Process

a. A bidder can appeal the department's decision to deny the bidder's good faith waiver request. The bidder must provide written documentation refuting the specific reasons for rejection as stated in the department's rejection notice. The bidder may meet in person with the department if so

requested. Failure to appeal within 7 calendar days after receiving the department's written notice of rejection of a good faith waiver request under constitutes a forfeiture of the bidder's right of appeal. If the bidder does not appeal, the department may declare the bid ineligible for execution.

b. The department will appoint a representative, who did not participate in the original determination, to assess the bidder's appeal. The department will issue a written decision within 7 calendar days after the bidder presents all written and oral testimony. In that written decision, the department will explain the basis for finding that the bidder did or did not meet the contract DBE goal or make an adequate good faith effort to meet the contract DBE goal. The department's decision is final. If the department finds that the bidder did not meet the contract DBE goal or did not make adequate efforts to meet the DBE goal, the department may declare the bid ineligible for execution.

7. Department's Criteria for DBE Participation

Department's DBE List

a. The department maintains a DBE list on the department's website at

http://app.mylcm.com/wisdot/Reports/WisDotUCPDirectory.aspx

b. The DBE office is also available to assist at 414-438-4583 or 608-266-6961.

8. Counting DBE Participation

Assessing DBE Work

a. The department will only count the DBE usage towards the contract DBE goal if the DBE firm is certified as a DBE by one of the unified certification program agencies. If a firm becomes DBE certified before entering into a subcontract, the department may consider that DBE usage towards the contract goal. The department only counts the value of the work a DBE actually performs towards the DBE goal. The department assesses the DBE work as follows:

b. The department counts work performed by the DBE's own resources. The department includes the cost of materials and supplies the DBE obtains for the work. The department also includes the cost of equipment the DBE leases for the work. The department will not include the cost of materials, supplies, or equipment the DBE purchases or leases from the prime contractor or its affiliate, except the department will count non-project specific leases the DBE has in place before the work is advertised.

c. The department counts fees and commissions the DBE charges for providing a bona fide professional, technical, consultant, or managerial services. The department also counts fees and commissions the DBE charges for providing bonds or insurance. The department will only count costs the engineer deems reasonable based on experience or prevailing market rates.

d. If a DBE subcontracts work, the department counts the value of the subcontracted work only if the DBE's subcontractor is also a DBE.

e. The contractor shall maintain records and may be required to furnish periodic reports documenting its performance under this item.

f. It is the prime contractor’s responsibility to determine the DBE's ability to perform the work with the use of the UCP directory.

9. Commercially Useful Function

a. The department counts expenditures of a DBE toward the DBE goal only if the DBE is performing a commercially useful function on that contract.

b. A DBE is performing a commercially useful function if the following conditions are met:

c. For contract work, the DBE is responsible for executing a distinct portion of the contract work and it is carrying out its responsibilities by actually performing, managing, and supervising that work.

d. For materials and supplies, the DBE is responsible for negotiating price, determining quality and quantity, ordering, and paying for those materials and supplies.

10. Trucking

All bidders are expected to adhere to the department's current trucking policy posted on the HCCI website at

http://www.dot.wisconsin.gov/business/engrserv/docs/dbe-trucking-notice.pdf

11. Manufacturers and Suppliers

The department counts material and supplies a DBE provides under the contract. The department will give full credit toward the DBE goal if the DBE is a manufacturer of those materials or supplies. The department will give 60 percent credit toward the DBE goal if the DBE is merely a supplier of those materials or supplies. It is the bidder's responsibility to find out if the DBE is considered a supplier or a manufacturer before listing them on Commitment to Subcontract to DBE form DT1506.

12. DBE Prime

If the prime contractor is a DBE, the department will only count the work the contractor performs with its own forces, the work DBE subcontractors perform, and the work DBE suppliers or manufacturers perform.

13. Joint Venture

If a DBE performs as a participant in a joint venture, the department will only count that portion of the total dollar value of the contract equal to that portion of the work that the DBE performs with its own forces.

14. Mentor Protégé

a. If a DBE performs as a participant in a mentor protégé agreement, the department will credit the portion of the work performed by the DBE protégé firm

b. On every other project that the mentor protégé team identifies itself on.

c. For no more than one half of the total contracted DBE goal on any WisDOT project.

15. DBE Replacement

In the event a Prime Contractor needs to replace a DBE firm originally listed on the approved DBE Commitment Form DT1506, the Prime Contractor must comply with the department's DBE Replacement Policy located on the DBE page on the following web site:

http://www.dot.wisconsin.gov/business/engrserv/docs/policyreplacingdbe.pdf

16. Changes to the approved DBE Commitment Form DT1506

If there are any changes to the approved Commitment to Subcontract to DBE Form DT1506, the prime contractor must submit a revised DBE Commitment Form DT1506 and relevant attachment A(s) to the DBE Programs Office within 5 business days.

17. Contract Modifications

When additional opportunity is available by contract modifications, the Prime Contractor shall utilize DBE Subcontractors, that were committed to equal work items, in the original contract.

18. Payment

Costs for conforming to this Additional Special Provision (ASP) and any associated DBE requirements are incidental to the contract.

APPENDIX A
Sample Contractor Solicitation Letter Page 1
This sample is provided as a guide not a requirement

GFW SAMPLE MEMORANDUM

TO: DBE FIRMS

FROM: POTENTIAL PRIME CONTRACTOR OR MAJOR SUBCONTRACTOR

SUBJECT: **REQUEST FOR DBE QUOTES**

LET DATE & TIME

DATE: MONTH DAY YEAR

CC: DBE OFFICE ENGINEER

Our company is considering bidding on the projects indicated on the next page, as a prime and/or a subcontractor for the Wisconsin Department of Transportation Month- date -year Letting. Page 2 lists the projects and work items that we may subcontract for this letting. We are interested in obtaining subcontractor quotes for these projects and work categories. Also note that we are willing to accept quotes in areas we may be planning to perform ourselves as required by federal rules.

Please review page 2, respond whether you plan to quote, highlight the projects and work items you are interested in performing and return it via fax or email within 3 days. Plans, specifications and addenda are available through WisDOT at the DBE Support Services office or at the Highway Construction Contract Information (HCCI) site at http://roadwaystandards.dot.wi.gov/hcci/

Your quote should include all of the costs required to complete the items you propose to perform including labor, equipment, material, and related bonding or insurance. The quote should note items that you are DBE certified to perform, tied items, and any special terms. Page 2, with the indicated projects and items you plan to quote, should be used as a cover sheet for your quote.

Please make every effort to have your quotes into our office by time deadline the prior to the letting date. ***Make sure the correct letting date, project ID and proposal number, unit price and extension are included in your quote.*** We prefer quotes be sent via SBN but prime's alternative's are acceptable. Our office hours are include hours and days. Please call our office as soon as possible prior to the letting if you need information/clarification to prepare your quote at contact number.

If you wish to discuss or evaluate your quote in more detail, contact us after the contract is awarded. Status of the contract can be checked at WisDOT's HCCI site at http://roadwaystandards.dot.wi.gov/hcci/

All questions should be directed to:

Project Manager, John Doe,
Phone: (000) 123-4567
Email: Joe@joetheplumber.com
Fax: (000) 123- 4657

Sample Contractor Solicitation Letter Page 2

This sample is provided as a guide not a requirement

REQUEST FOR QUOTATION

Prime's Name: _____

Letting Date: _____

Project ID: _____

Please check all that apply

- ☐ Yes, we will be quoting on the projects and items listed below
- ☐ No, we are not interested in quoting on the letting or its items referenced below
- ☐ Please take our name off your monthly DBE contact list
- ☐ We have questions about quoting this letting. Please have some one contact me at this number

Prime Contractor 's Contact Person		DBE Contractor Contact Person	
Phone:		Phone	
Fax:		Fax	
Email:		Email	

Please circle the jobs and items you will be quoting below

Proposal No.	1	2	3	4	5	6	7
County							

WORK DESCRIPTION:

Clear and Grub	X		X	X		X	X
Dump Truck Hauling	X		X	X		X	X
Curb & Gutter/Sidewalk, Etc.	X		X	X		X	X
Erosion Control Items	X		X	X		X	X
Signs and Posts/Markers	X		X	X		X	X
Traffic Control		X	X	X		X	X
Electrical Work/Traffic Signals		X	X	X		X	
Pavement Marking		X	X	X	X	X	X
Sawing Pavement		X	X	X	X	X	X
QMP, Base	X	X		X	X	X	X
Pipe Underdrain	X			X			
Beam Guard				X	X	X	X
Concrete Staining							X
Trees/Shrubs	X						X

Again please make every effort to have your quotes into our office by time deadline prior to the letting date.

We prefer quotes be sent via SBN but prime's preferred alternative's are acceptable.

If there are further questions please direct them to the prime contractor's contact person at phone number.

APPENDIX B
BEST PRACTICES FOR PRIME CONTRACTOR & DBE SUBCONTRACTOR GOOD FAITH EFFORT

This list is not a set of requirements; it is a list of potential strategies

Primes

- Prime contractor open houses inviting DBE firms to see the bid "war room" or providing technical assistance
- Participate in speed networking and mosaic exercises as arranged by DBE office
- Host information sessions not directly associated with a bid letting;
- Participate in a formal mentor protégé or joint venture with a DBE firm
- Participate in WisDOT advisory committees i.e. TRANSAC, or Mega Project committee meetings
- Facilitate a small group DBE 'training session' Clarifying how your firm prepares for bid letting, evaluates subcontractors, preferred qualifications and communication methods
- Encourage subcontractors to solicit and highlight DBE participation in their quotes to you
- Quality of communication, not quantity creates the best results. Contractors should do as thorough a job as possible in communicating with DBE firms before the bid and provide any assistance requested to assure best possible bid.

DBE

- DBE firms should contact primes as soon as possible with questions regarding their quotes or bid; seven days prior is optimal.
- Continually check for contract addendums on the HCCI website through the Thursday prior to letting to stay abreast of changes.
- Review the status of contracts on the HCCI website reviewing the 'apparent low bidder' list, and bid tabs at a minimum.
- Prepare a portfolio or list of related projects and prime and supplier references; be sure to note transportation-related projects of similar size and scope, firm expertise and staffing.
- Participate in DBE office assessment programs
- Participate on advisory and mega-project committees
- Sign up to receive the DBE Contracting Update
- Consider membership in relevant industry or contractor organizations
- Active participation is a must. Quote as many projects as you can reasonably work on; quoting the primes and bidding as a prime with the department are the only ways to get work.

APPENDIX C
Types of Efforts considered in determining GFE
This list represents concepts being assessed; analysis requires additional steps

1. Whether the contractor attended any pre-solicitation or pre-bid meetings that were scheduled by WisDOT to inform DBEs of contracting and subcontracting opportunities;
2. Whether the contractor provided written notice to a reasonable number of specific DBEs that their interest in the contract was being solicited, in sufficient time to allow the DBEs to participate effectively;
3. Whether the contractor followed up initial solicitations of interest by contacting DBEs to determine if the DBEs were interested; returned the phone calls of interested DBE firms.
4. Whether the contractor selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the DBE goal;
5. Whether the contractor provided interested DBEs with adequate information about the plans, specifications and requirements of the contract;
6. Whether the contractor negotiated in good faith with interested DBEs, not rejected DBEs as unqualified without sound reasons based on a thorough investigation of their capabilities;
7. Whether the contractor made efforts to assist interested DBEs in being more competitive.
8. Whether the contractor effectively used the services of available minority community organizations: minority contractors groups, local, state, and Federal minority business assistance offices, and other organizations that provide assistance to small businesses and DBE firms.
9. Whether Prime used CRCS to identify DBE who specialize in relevant work areas.
10. Whether the contractor used available resources including contacting the DBE office, using WisDOT's website
11. Whether the contractor returned calls of firms expressing interest in a timely manner.

APPENDIX D
Good Faith Effort Evaluation Guidance
Excerpt from Appendix A of 49 CFR Part 26

APPENDIX A TO PART 26 -- GUIDANCE CONCERNING GOOD FAITH EFFORTS

I. When, as a recipient, you establish a contract goal on a DOT assisted contract, a bidder must, in order to be responsible and/or responsive, make good faith efforts to meet the goal. The bidder can meet this requirement in either of two ways. First, the bidder can meet the goal, documenting commitments for participation by DBE firms sufficient for this purpose. Second, even if it doesn't meet the goal, the bidder can document adequate good faith efforts. This means that the bidder must show that it took all necessary and reasonable steps to achieve a DBE goal or other requirement of this part which, by their scope, intensity, and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not fully successful.

II. In any situation in which you have established a contract goal, part 26 requires you to use the good faith efforts mechanism of this part. As a recipient, it is up to you to make a fair and reasonable judgment whether a bidder that did not meet the goal made adequate good faith efforts. It is important for you to consider the quality, quantity, and intensity of the different kinds of efforts that the bidder has made. The efforts employed by the bidder should be those that one could reasonably expect a bidder to take if the bidder were actively and aggressively trying to obtain DBE participation sufficient to meet the DBE contract goal. Mere pro forma efforts are not good faith efforts to meet the DBE contract requirements. We emphasize, however, that your determination concerning the sufficiency of the firm's good faith efforts is a judgment call: meeting quantitative formulas is not required.

III. The Department also strongly cautions you against requiring that a bidder meet a contract goal (i.e., obtain a specified amount of DBE participation) in order to be awarded a contract, even though the bidder makes an adequate good faith efforts showing. This rule specifically prohibits you from ignoring bona fide good faith efforts.

IV. The following is a list of types of actions which you should consider as part of the bidder's good faith efforts to obtain DBE participation. It is not intended to be a mandatory checklist, nor is it intended to be exclusive or exhaustive. Other factors or types of efforts may be relevant in appropriate cases.

A. Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBEs who have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBEs to respond to the solicitation. The bidder must determine with certainty if the DBEs are interested by taking appropriate steps to follow up initial solicitations.

B. Selecting portions of the work to be performed by DBEs in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the prime contractor might otherwise prefer to perform these work items with its own forces.

C. Providing interested DBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

D. (1) Negotiating in good faith with interested DBEs. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBEs to perform the work.

(2) A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBEs is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also, the ability or desire of a prime contractor to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Prime contractors are not, however, required to accept higher quotes from DBEs if the price difference is excessive or unreasonable.

E. Not rejecting DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. The contractor's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non solicitation of bids in the contractor's efforts to meet the project goal.

F. Making efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance as required by the recipient or contractor.

G. Making efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services.

H. Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and Federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBEs.

V. In determining whether a bidder has made good faith efforts, you may take into account the performance of other bidders in meeting the contract. For example, when the apparent successful bidder fails to meet the contract goal, but others meet it, you may reasonably raise the question of whether, with additional reasonable efforts, the apparent successful bidder could have met the goal. If the apparent successful bidder fails to meet the goal, but meets or exceeds the average DBE participation obtained by other bidders, you may view this, in conjunction with other factors, as evidence of the apparent successful bidder having made good faith efforts.

Appendix E
Small Business Network [SBN] Overview

The Small Business Network is a part of the Bid Express® service that was created to ensure that prime bidders have a centralized online location to find subs - including small and disadvantaged business enterprises (DBEs). It is available for prime bidders to use as part of their Basic Service subscription. Within the Small Business Network, **Prime Contractors** can:

1. Easily select proposals, work types and items:
    a. After adding applicable work types, select items that you wish to quote. Enter the sub-quote quantities and add comments, if desired. Adding or removing items and work types can be done quickly. If needed, you can save the sub-quote for completion at a later time.
2. Create sub-quotes for the subcontracting community:
    a. Create sub-quotes with ease using the intuitive sub-quote creator. In seven short steps, you can rapidly create a custom sub-quote directed to all subcontractors that bid on the applicable work types. Steps include: provide contact information and sub-quote expiration date, select letting and proposal, add work types and items, specify terms and conditions, upload attachments, and select vendors.
    b. Create a sub-quote to send to subcontractors or suppliers that lists the items in a proposal that you want quoted
    c. Create an unlimited number of sub-quotes for items you want quoted, and optionally mark them as a DBE-preferred request
    d. Add attachments to sub-quotes
3. View sub-quote requests & responses:
    a. After logging into the Bid Express service, you can quickly review all of your sub-quote requests and all unsolicited sub-quote requests from subcontractors. To simplify the Small Business Network home screen, sub-quote requests can be hidden with one click if they are not applicable.
    b. View or receive unsolicited sub-quotes that subcontractors have posted, complete with terms, conditions and pricing
4. View Record of Subcontractor Outreach Effort:
    a. For each sub-quote produced, a *Record of Subcontractor Outreach Effort* is generated that shows the response statistics for a particular sub-quote. If accepted by the letting agency, this report may serve as proof of a "Good Faith" effort in reaching out to the DBE community.
    b. Easily locate pre-qualified and certified small and disadvantaged businesses
    c. Advertise to small and disadvantaged businesses more efficiently and cost effectively
    d. Document your interactions with subs/DBEs by producing an Outreach Report (may be accepted as proof of DBE outreach at the discretion of each agency)

The Small Business Network is a part of the Bid Express® service that was created to ensure that small businesses have a centralized area to access information about upcoming projects. It can help small businesses learn more about opportunities, compete more effectively, network with other contractors and subcontractors, and win more jobs.

1. View and reply to sub-quote requests from primes:
    a. After logging into the Bid Express service, you can quickly review all incoming sub-quote requests and all unsolicited sub-quotes created by your company. Receive notifications by selected work type. To simplify on the Small Business Network home screen, sub-quote requests can be filtered by work types relevant to your interests, or hidden with one click if they are not applicable.
2. Select items when responding to sub-quote requests from primes:
    a. You have the freedom to choose and price any number of items when responding to a sub-quote request. Quantities can be modified, and per-item comments are also available.
    b. View requests for sub-quotes for work that primes have posted for projects they are bidding, add your pricing, terms, and conditions, and submit completed sub-quotes to the requesting primes
    c. Add attachments to a sub-quote
3. Create and send unsolicited sub-quotes to specific contractors:
    a. Create unsolicited sub-quotes with ease using the intuitive sub-quote creator. In eight short steps, you can rapidly create a custom sub-quote directed at any number of specific vendors of your choosing. Steps include: provide contact information and sub-quote expiration date, select letting and proposal, add work types and items, specify terms and conditions, upload attachments, and select vendors.
4. Easily select and price items for unsolicited sub-quotes:
    a. After adding applicable work types, select items that you wish to quote. The extended price calculates automatically, cutting out costly calculation errors. Comments can be provided on an per-item basis as well.
    b. Create an unsolicited sub-quote that lists the items from a proposal that you want to quote, include pricing, terms and conditions, and send it to selected prime/plan holder
    c. Add attachments to a sub-quote
    d. Add unsolicited work items to sub-quotes that you are responding to
5. Easy Access to Valuable Information
    a. Receive a confirmation that your sub-quote was opened by a prime
    b. View Bid Tab Analysis data from past bids, including the high, average and low prices of items.
    c. View important notices and publications from DOT targeted to small and disadvantaged businesses
6. Accessing Small Business Network for WisDOT contracting opportunities
    a. If you are a contractor not yet subscribing to the Bid Express service, go to **www.bidx.com** and select "Order Bid Express." The Small Business Network is a part of the Bid Express Basic Service.
    b. DBE firms can request a Bid Express Small Business Network Account at no cost by calling 414-438-4588

ADDITIONAL SPECIAL PROVISION 4

Payment to First-Tier Subcontractors

Within 10 calendar days of receiving a progress payment for work completed by a subcontractor, pay the subcontractor for that work. The prime contractor may withhold payment to a subcontractor if, within 10 calendar days of receipt of that progress payment, the prime contractor provides written notification to the subcontractor and the department documenting "just cause" for withholding payment.

The prime contractor may also withhold routine retainage from payments due subcontractors.

Payment to Lower-Tier Subcontractors

Ensure that subcontracting agreements at all tiers provide prompt payment rights to lower-tier subcontractors that parallel those granted first-tier subcontractors in this provision.

Release of Routine Retainage

After granting substantial completion the department may reduce the routine retainage withheld from the prime contractor to 75 percent of the original total amount retained.

When the Department sends the semi-final estimate the department may reduce the routine retainage withheld from the prime contractor to 10 percent of the original total amount retained.

Within 30 calendar days of receiving the semi-final estimate from the department, submit written certification that subcontractors at all tiers are paid in full for acceptably completed work and that no routine retainage is being withheld. The department will pay the prime contractor in full and reduce the routine retainage withheld from the prime contractor to zero when the department approves the final estimate.

This special provision does not limit the right of the department, prime contractor, or subcontractors at any tier to withhold payment for work not acceptably completed or work subject to an unresolved contract dispute.

ADDITIONAL SPECIAL PROVISION 6

ASP 6 - Modifications to the standard specifications

Make the following revisions to the 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://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm

(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://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/crc-basic-info.pdf

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. General
II. Nondiscrimination
III. Nonsegregated Facilities
IV. Davis-Bacon and Related Act Provisions
V. Contract Work Hours and Safety Standards Act Provisions
VI. Subletting or Assigning the Contract
VII. Safety: Accident Prevention
VIII. False Statements Concerning Highway Projects
IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
X. Compliance with Governmentwide Suspension and Debarment Requirements
XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under

this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are

applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor

will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH–1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or

will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b.(1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g. , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;
(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

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

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

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. “First Tier Covered Transactions” refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

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

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

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

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

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

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

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

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

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

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

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

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

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

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the

department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

SEPTEMBER 2002

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Employment Practices" and "Equal Opportunity Clause" set forth in the Required Contract Provisions, FHWA 1273.

2. The goals and timetables for minority and female participation expressed in percentage terms for the contractor's aggregate work force in each trade, on all construction work in the covered area, are as follows:

Goals for Minority Participation for Each Trade:

County	%	County	%	County	%
Adams	1.7	Iowa	1.7	Polk	2.2
Ashland	1.2	Iron	1.2	Portage	0.6
Barron	0.6	Jackson	0.6	Price	0.6
Bayfield	1.2	Jefferson	7.0	Racine	8.4
Brown	1.3	Juneau	0.6	Richland	1.7
Buffalo	0.6	Kenosha	3.0	Rock	3.1
Burnett	2.2	Kewaunee	1.0	Rusk	0.6
Calumet	0.9	La Crosse	0.9	St. Croix	2.9
Chippewa	0.5	Lafayette	0.5	Sauk	1.7
Clark	0.6	Langlade	0.6	Sawyer	0.6
Columbia	1.7	Lincoln	0.6	Shawano	1.0
Crawford	0.5	Manitowoc	1.0	Sheboygan	7.0
Dane	2.2	Marathon	0.6	Taylor	0.6
Dodge	7.0	Marinette	1.0	Trempealeau	0.6
Door	1.0	Marquette	1.7	Vernon	0.6
Douglas	1.0	Menominee	1.0	Vilas	0.6
Dunn	0.6	Milwaukee	8.0	Walworth	7.0
Eau Claire	0.5	Monroe	0.6	Washburn	0.6
Florence	1.0	Oconto	1.0	Washington	8.0
Fond du Lac	1.0	Oneida	0.6	Waukesha	8.0
Forest	1.0	Outagamie	0.9	Waupaca	1.0
Grant	0.5	Ozaukee	8.0	Waushara	1.0
Green	1.7	Pepin	0.6	Winnebago	0.9
Green Lake	1.0	Pierce	2.2	Wood	0.6

Goals for female participation for each trade: 6.9%

These goals are applicable to all the contractor's construction work, (whether or not it is federal or federally assisted), performed in the covered area. If the contractor performs construction work in the geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The contractor's compliance with the Executive Order and the Regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project for the sole purpose of meeting the contractor's goals shall be a violation of the contract, the Executive Order and the Regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within ten (10) working days of award of any construction subcontract in excess of $10,000.00 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor, employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

   As referred to in this section, the Director means:

   Director
   Office of Federal Contract Compliance Programs
   Ruess Federal Plaza
   310 W. Wisconsin Ave., Suite 1115
   Milwaukee, WI 53202

   The "Employer Identification Number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

4. As used in this notice, and in the contract resulting from solicitation, the "covered area" is the county(ies) in Wisconsin to which this proposal applies.

APRIL 2013

ADDITIONAL FEDERAL-AID PROVISIONS

NOTICE TO ALL BIDDERS

To report bid rigging activities call:

1-800-424-9071

The U.S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m., Eastern Time. Anyone with knowledge of possible bid rigging, bidding collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

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
MILWAUKEE COUNTY

Compiled by the State of Wisconsin - Department of Workforce Development
for the Department of Transportation
Pursuant to s. 103.50, Stats.
Issued on January 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	35.80	16.87	52.67
Carpenter	33.68	19.81	53.49
Future Increase(s): Add $1.25/hr on 6/2/2014.			
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.			
Cement Finisher	31.56	18.53	50.09
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	32.82	22.61	55.43
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	3.33	19.33
Ironworker	30.51	23.23	53.74
Line Constructor (Electrical)	38.25	17.63	55.88
Painter	21.87	11.37	33.24
Pavement Marking Operator	30.00	0.00	30.00
Piledriver	27.67	25.64	53.31
Roofer or Waterproofer	29.40	15.55	44.95
Teledata Technician or Installer	24.75	16.08	40.83
Tuckpointer, Caulker or Cleaner	34.57	16.42	50.99
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	15.07	45.67
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	21.04	11.74	32.78
TRUCK DRIVERS			
Single Axle or Two Axle	34.22	19.90	54.12
Three or More Axle	25.24	15.20	40.44
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	25.24	15.20	40.44
Shadow or Pilot Vehicle	34.22	19.90	54.12
Truck Mechanic	25.24	15.20	40.44
LABORERS			
General Laborer	26.06	19.43	45.49
Future Increase(s): Add $1.60/hr on 6/1/2014. Premium Pay: Add $.15/hr for air tool operator, joint sawer and filler (pavement), vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add $.35/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add $.50/hr for line and grade specialist; Add $.65/hr for blaster and powderman; Add $2.01/hr for topman; Add $2.46/hr for bottomman; Add $3.23/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	0.00	19.00
Landscaper	26.06	19.43	45.49
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	22.55	19.43	41.98
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.			
Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.69	15.50	33.19
Railroad Track Laborer	13.50	4.06	17.56

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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 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	35.72	20.40	56.12

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	$	$	$
& 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	16.65	43.34
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, 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

TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY	HOURLY FRINGE BENEFITS	TOTAL
	$	$	$

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin
GENERAL DECISION NUMBER: WI140010
DATE: March 14, 2014
DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

LABORERS CLASSIFICATION:	Basic Hourly Rates	Fringe Benefits
Group 1: General Laborer; Tree Trimmer; Conduit Layer; Demolition and Wrecking Laborer; Guard Rail, Fence and Bridge Builder; Landscaper, Multiplate Culvert Assembler; Stone Handler; Bituminous Worker (Shoveler, Loader, Utility Man); Batch Truck Dumper; or Cement Handler; Bituminous Worker; (Dumper, Ironer, Smoother, Tamper); Concrete Handler	$26.06	18.15
Group 2: Air Tool Operator; Joint Sawer and Filler (Pavement); Vibrator or Tamper Operator (Mechanical Hand Operated); Chain Saw Operator; Demolition Burning Torch Laborer	26.21	18.15
Group 3: Bituminous Worker (Raker and Luteman); Formsetter (Curb, Sidewalk, and Pavement); Strike Off man	26.41	18.15
Group 4: Line and Grade Specialist	26.56	18.15
Group 5: Blaster and Powderman	26.71	18.15
Group 6: Flagperson traffic control person	22.55	18.15

CLASSES OF LABORER AND MECHANICS

Bricklayer	35.58	16.07
Carpenter	30.52	14.41
Piledriverman	27.25	19.46
Ironworker	30.52	23.47
Cement Mason/Concrete Finisher	30.69	17.53
Electrician		See Page 3
Line Construction		
Lineman	39.50	32% + 5.00
Heavy Equipment Operator	37.53	32% + 5.00
Equipment Operator	31.60	32% + 5.00
Heavy Groundman Driver	26.78	14.11
Light Groundman Driver	24.86	13.45
Groundsman	21.73	32% + 5.00
Millwrights	26.32	13.98
Painter, Brush	29.52	20.04
Painter, Spray and Sandblaster	30.27	20.04
Painter, Bridge	29.87	20.04
Well Drilling:		
Well Driller	16.52	3.70

	Basic Hourly Rates	Fringe Benefits
Truck Drivers:		
1 & 2 Axles	23.82	18.32
Three or More Axles; Euclids, Dumptor & Articulated, Truck Mechanic	23.97	18.32

Notes: Welders receive rate prescribed for craft performing operation to which welding is incidental. Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR, 5.5(a)(1)(ii)). Includes Modification #0, dated January 3, 2014; Modification #1, dated February 7, 2014; Modification #2, dated March 14, 2014.

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin
GENERAL DECISION NUMBER: WI140010
DATE: March 14, 2014
DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

POWER EQUIPMENT OPERATORS CLASSIFICATION:	Basic Hourly Rates	Fringe Benefits
Group 1: Cranes, tower cranes and derricks, with or without attachments, with a lifting capacity of over 100 tons or cranes, tower cranes and derricks with boom, leads and/or jib lengths measuring 176 feet or longer	$36.72	$20.10
Group 2: Cranes, tower cranes and derricks, with or without attachments, with a lifting capacity of 100 tons or less or cranes, tower cranes and derricks with boom, leads and/or jib lengths measuring 175 feet or less, and backhoes (excavators) having a manufacturer's rated capacity of 3 cu. yds. and over, caisson rigs, pile driver, dredge operator, dredge engineer.	$36.22	$20.10
Group 3: Mechanic or welder - heavy duty equipment, cranes with a lifting capacity of 25 tons or less, concrete breaker (manual or remote); vibrator/sonic concrete breaker; concrete laser screed; concrete slipform paver; concrete batch plant operator; concrete pavement spreader - heavy duty (rubber tired); concrete spreader and distributor, automatic subgrader (concrete); concrete grinder and planing machine; concrete slipform curb and gutter machine; slipform concrete placer; tube finisher; hydro blaster (10,000 psi and over); bridge paver; concrete conveyor system; concrete pump; stabilizing mixer (self propelled); shoulder widener; asphalt plant engineer; bituminous paver; bump cutter and grooving machine; milling machine; screed (bituminous paver); asphalt heater, planer and scarifier; backhoes (excavators) having a manufacturers rated capacity of under 3 cu. yds.; grader or motor patrol; tractor (scraper, dozer, pusher, loader); scraper - rubber tired (single or twin engine); endloader hydraulic backhoe (tractor-type); trenching machine; skid rigs; tractor, side boom (heavy); drilling or boring machine (mechanical heavy); roller (over 5 tons); percussion or rotary drilling machine; air track; blaster; loading machine (conveyor); tugger; boatmen; winches and A-frames; post driver; material hoist operator.	$35.72	$20.10
Group 4: Greaser, roller steel (5 tons or less); roller (pneumatic tired) - self-propelled; tractor (mounted or towed compactors and light equipment); shouldering machine; self-propelled chip spreader; concrete spreader; finishing machine; mechanical float; curing machine; power subgrader; joint saw (multiple blade) belting machine; burlap machine; texturing machine; tractor, endloader (rubber tired) - light; jeep digger; fork lift; mulcher; launch operator; fireman; environmental burner.	$35.46	$20.10
Group 5: Air compressor; power pack; vibratory hammer and extractor; heavy equipment, leadman; tank car heaters; stump chipper; curb machine operator; concrete pro-portioning plants generators; mudjack operator; rock breaker; crusher or screening plant; screed (milling machine); automatic belt conveyor and surge bin; pug mill operator; oiler; pump (over 3 inches); drilling machine helper.	$35.17	$20.10
Group 6: Off – road material hauler with or without ejector	$29.27	$20.10

Premium Pay:
EPA Level "A" protection - $3.00 per hour
EPA Level "B" protection - $2.00 per hour
EPA Level "C" protection - $1.00 per hours

SUPERSEDES DECISION WI20120010
U. S. DEPARTMENT OF LABOR
(DAVIS-BACON ACT, MINIMUM WAGE RATES)

STATE: Wisconsin
GENERAL DECISION NUMBER: WI140010
DATE: March 14, 2014
DESCRIPTION OF WORK: Highways and Airport Runway and Taxiway Construction

LABORERS CLASSIFICATION:	Rates	Benefits
Electricians		
Area 1	$28.40	16.676
Area 2:		
Electricians	29.13	17.92
Area 3:		
Electrical contracts under $130,000	26.24	16.85
Electrical contracts over $130,000	29.41	16.97
Area 4:	28.50	28.75% + 9.27
Area 5	28.96	24.85% + 9.70
Area 6	35.25	19.30
Area 8		
Electricians	30.60	24.95% + 10.33
Area 9:		
Electricians	32.94	18.71
Area 10	28.97	19.55
Area 11	31.91	23.60
Area 12	32.87	19.23
Area 13	32.82	22.51
Teledata System Installer		
Area 14		
Installer/Technician	21.89	11.83
Sound & Communications		
Area 15		
Installer	16.47	14.84
Technician	24.75	16.04

Area 1 - CALUMET (except township of New Holstein), GREEN LAKE (N. part, including Townships of Berlin, St. Marie and Seneca), MARQUETTE (N. part, including Townships of Crystal Lake, Neshkoro, Newton & Springfield), OUTAGAMIE, WAUPACA, WAUSHARA and WINNEBAGO COUNTIES.

Area 2 - ASHLAND, BARRON, BAYFIELD, BUFFALO, BURNETT, CHIPPEWA, CLARK (except Mayville, Colby, Unity, Sherman, Fremont, Lynn and Sherwood), CRAWFORD, DUNN, EAU CLAIRE, GRANT, IRON, JACKSON, LA CROSSE, MONROE, PEPIN, PIERCE, POLK, PRICE, RICHLAND, RUSK, ST. CROIX, SAWYER, TAYLOR, TREMPEALEAU, VERNON and WASHBURN COUNTIES

Area 3 - FLORENCE (townships of Aurora, Commonwealth, Fern, Florence and Homestead), MARINETTE (Niagara township)

Area 4 - BROWN, DOOR, KEWAUNEE, MANITOWOC (except Schleswig), MARINETTE (Wausauke and area south thereof), OCONTO, MENOMINEE (East of a line 6 miles West of the West boundary of Oconto County), SHAWANO (except area North of Townships of Aniwa and Hutchins) COUNTIES.

Area 5 - ADAMS, CLARK (Colby, Freemont, Lynn, Mayville, Sherman, Sherwood, Unity), FOREST, JUNEAU, LANGLADE, LINCOLN, MARATHON, MARINETTE (Area North of the town of Wausaukee), MENOMINEE (Area West of a line 6 miles West of the West boundary of Oconto County), ONEIDA, PORTAGE, SHAWANO (Area North of the townships of Aniwa and Hutchins), VILAS AND WOOD COUNTIES

Area 6 - KENOSHA COUNTY

Area 8 - DODGE, (Emmet Township only), GREEN, JEFFERSON, LAFAYETTE, RACINE (Burlington township), ROCK and WALWORTH COUNTIES

Area 9 - COLUMBIA, DANE, DODGE, (area west of Hwy. 26, except Chester & Emmet Townships), GREEN LAKE (except townships of Berlin, Seneca and St. Marie), IOWA, MARQUETTE (except townships of Neshkoka, Crystal Lake, Newton and Springfield), and SAUK COUNTIES

Area 10 - CALUMET (Township of New Holstein), DODGE (East of Hwy. 26 including Chester Township), FOND DU LAC, MANITOWOC (Schleswig), and SHEBOYGAN COUNTIES

Area 11 - DOUGLAS COUNTY

Area 12 - RACINE (except Burlington township) COUNTY

Area 13 - MILWAUKEE, OZAUKEE, WASHINGTON and WAUKESHA COUNTIES

Area 14 - Statewide.

Area 15 - DODGE (East of Hwy 26 including Chester Twp, excluding Emmet Twp), FOND DU LAC (Except Waupun), MILWAUKEE, OZAUKEE, MANITOWOC (Schleswig), WASHINGTON, AND WAUKESHA COUNTIES.

FEBRUARY 1999

NOTICE TO BIDDERS
WAGE RATE DECISION

The wage rate decision of the Secretary of Labor which has been incorporated in these advertised specifications is incomplete in that the classifications may be omitted from the Secretary of Labor's decision.

Since the bidder is responsible, independently, for ascertaining area practice with respect to the necessity, or lack of necessity, for the use of these classifications in the prosecution of the work contemplated by this project, no inference may be drawn from the omision of these classifications concerning prevailing area practices relative to their use. Further, this omission will not, per se, be construed as establishing any governmental liability for increased labor cost if it is subsequently determined that such classifications are required.

There may be omissions and/or errors in the federal wage rates. The bidder is responsible for evaluating and determining the correct applicable rate. The higher of state or federal rate will apply.

CONTRACT: 20140513019 PROJECT(S): 1000-40-70 FEDERAL ID(S): WISC 2014176

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	108.4400 CPM PROGRESS SCHEDULE	1.000 EACH		.		.
0020	204.0265 ABANDONING WELLS	4.000 EACH		.		.
0030	205.0501.S EXCAVATION, HAULING, AND DISPOSAL OF PETROLEUM CONTAMINATED SOIL	2,900.000 TON		.		.
0040	213.0100 FINISHING ROADWAY (PROJECT) 01. 1000-40-70	1.000 EACH		.		.
0050	305.0120 BASE AGGREGATE DENSE 1 1/4-INCH	100.000 TON		.		.
0060	310.0110 BASE AGGREGATE OPEN GRADED	440.000 TON		.		.
0070	616.0800.S FENCE TRACK CLEARANCE	2,400.000 LF		.		.
0080	619.1000 MOBILIZATION	1.000 EACH		.		.
0090	625.0500 SALVAGED TOPSOIL	300.000 SY		.		.
0100	627.0200 MULCHING	300.000 SY		.		.

CONTRACT: 20140513019 PROJECT(S): 1000-40-70 FEDERAL ID(S): WISC 2014176

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0110	628.7560 TRACKING PADS	2.000 EACH		.		.
0120	629.0205 FERTILIZER TYPE A	0.200 CWT		.		.
0130	630.0140 SEEDING MIXTURE NO. 40	5.000 LB		.		.
0140	642.5001 FIELD OFFICE TYPE B	1.000 EACH		.		.
0150	643.0100 TRAFFIC CONTROL (PROJECT) 01. 1000-40-70	1.000 EACH		.		.
0160	650.6500 CONSTRUCTION STAKING STRUCTURE LAYOUT (STRUCTURE) 01. MILWAUKEE INTERMODAL STATION	LUMP	LUMP			.
0170	650.8000 CONSTRUCTION STAKING RESURFACING REFERENCE	9,600.000 LF		.		.
0180	656.0100 ELECTRICAL SERVICE METER SOCKET (LOCATION) 01. MILWAUKEE INTERMODAL STATION	LUMP	LUMP			.
0190	999.1500.S CRACK AND DAMAGE SURVEY	LUMP	LUMP			.
0200	SPV.0060 SPECIAL 01. PLATFORM SNOW REMOVAL	4.000 EACH		.		.

CONTRACT: 20140513019 PROJECT(S): 1000-40-70 FEDERAL ID(S): WISC 2014176

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0210	SPV.0090 SPECIAL 01. SUBSURFACE TRACK DRAIN WRAPPED	5,800.000 LF		.		.
0220	SPV.0090 SPECIAL 02. SUBSURFACE TRACK DRAIN UNPERFORATED	162.000 LF		.		.
0230	SPV.0105 SPECIAL 01. ABANDONING SEWER	LUMP	LUMP			.
0240	SPV.0105 SPECIAL 02. ADJUSTING SEWER MANHOLE COVER	LUMP	LUMP			.
0250	SPV.0105 SPECIAL 03. ABANDON WATERMAIN	LUMP	LUMP			.
0260	SPV.0105 SPECIAL 04. HDPE WATER SERVICE	LUMP	LUMP			.
0270	SPV.0105 SPECIAL 05. REINFORCED CONCRETE PLATFORM	LUMP	LUMP			.
0280	SPV.0105 SPECIAL 06. CONCRETE RETAINING WALL AND CHAIN LINK FENCE	LUMP	LUMP			.
0290	SPV.0105 SPECIAL 07. METAL ROOF DECK	LUMP	LUMP			.
0300	SPV.0105 SPECIAL 08. COLD FORMED METAL FRAMING	LUMP	LUMP			.
0310	SPV.0105 SPECIAL 09. METAL FABRICATIONS	LUMP	LUMP			.

CONTRACT: 20140513019 PROJECT(S): 1000-40-70 FEDERAL ID(S): WISC 2014176

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0320	SPV.0105 SPECIAL 10. RAILINGS AND HANDRAILS	LUMP	LUMP			.
0330	SPV.0105 SPECIAL 11. LIGHTED HANDRAIL SYSTEM	LUMP	LUMP			.
0340	SPV.0105 SPECIAL 12. METAL STAIR NOSINGS	LUMP	LUMP			.
0350	SPV.0105 SPECIAL 13. ARCHITECTURAL GLASS RAILING	LUMP	LUMP			.
0360	SPV.0105 SPECIAL 14. ALUMINUM DOWNSPOUTS	LUMP	LUMP			.
0370	SPV.0105 SPECIAL 15. BUILDING INSULATION	LUMP	LUMP			.
0380	SPV.0105 SPECIAL 16. COMPOSITE METAL PANELS	LUMP	LUMP			.
0390	SPV.0105 SPECIAL 17. CORRUGATED METAL PANELS	LUMP	LUMP			.
0400	SPV.0105 SPECIAL 18. EPDM MEMBRANE ROOFING	LUMP	LUMP			.
0410	SPV.0105 SPECIAL 19. SHEET METAL GUTTERS AND FLASHING	LUMP	LUMP			.
0420	SPV.0105 SPECIAL 20. JOINT SEALANTS	LUMP	LUMP			.

CONTRACT: 20140513019 PROJECT(S): 1000-40-70 FEDERAL ID(S): WISC 2014176

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0430	SPV.0105 SPECIAL 21. ALUMINUM DOORS AND FRAMES	LUMP	LUMP			.
0440	SPV.0105 SPECIAL 22. ALUMINUM WINDOW WALL	LUMP	LUMP			.
0450	SPV.0105 SPECIAL 23. AUTOMATIC ENTRANCE DOORS	LUMP	LUMP			.
0460	SPV.0105 SPECIAL 24. METAL FRAMED SKYLIGHTS	LUMP	LUMP			.
0470	SPV.0105 SPECIAL 26. GYPSUM BOARD ASSEMBLIES	LUMP	LUMP			.
0480	SPV.0105 SPECIAL 27. DETECTABLE WARNING TILES	LUMP	LUMP			.
0490	SPV.0105 SPECIAL 28. PAINTING	LUMP	LUMP			.
0500	SPV.0105 SPECIAL 29. LOUVERS AND VENTS	LUMP	LUMP			.
0510	SPV.0105 SPECIAL 30. SIGNAGE	LUMP	LUMP			.
0520	SPV.0105 SPECIAL 31. HOLELESS HYDRAULIC ELEVATORS	LUMP	LUMP			.
0530	SPV.0105 SPECIAL 32. HEAVY DUTY ESCALATORS	LUMP	LUMP			.

CONTRACT: 20140513019 PROJECT(S): 1000-40-70 FEDERAL ID(S): WISC 2014176

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0540	SPV.0105 SPECIAL 33. PRECAST CONCRETE PATCHING	LUMP	LUMP			.
0550	SPV.0105 SPECIAL 35. EXHAUST VENTILATORS	LUMP	LUMP			.
0560	SPV.0105 SPECIAL 36. GRAVITY VENTILATORS	LUMP	LUMP			.
0570	SPV.0105 SPECIAL 37. PLUMBING WORK	LUMP	LUMP			.
0580	SPV.0105 SPECIAL 38. MECHANICAL WORK	LUMP	LUMP			.
0590	SPV.0105 SPECIAL 39. ELECTRICAL WORK	LUMP	LUMP			.
0600	SPV.0105 SPECIAL 40. TEMPORARY SHORING	LUMP	LUMP			.
0610	SPV.0105 SPECIAL 41. PILING STEEL DELIVERED AND DRIVEN AND TESTED	LUMP	LUMP			.
0620	SPV.0105 SPECIAL 42. CONCRETE, STRUCTURES	LUMP	LUMP			.
0630	SPV.0105 SPECIAL 43. BAR STEEL REINFORCEMENT, STRUCTURES	LUMP	LUMP			.
0640	SPV.0105 SPECIAL 44. PRECAST PRESTRESSED SLAB SPANS	LUMP	LUMP			.

CONTRACT: 20140513019 PROJECT(S): 1000-40-70 FEDERAL ID(S): WISC 2014176

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0650	SPV.0105 SPECIAL 45. MEMBRANE WATERPROOFING	LUMP	LUMP			.
0660	SPV.0105 SPECIAL 46. COMPACTED BACKFILL	LUMP	LUMP			.
0670	SPV.0105 SPECIAL 47. STRUCTURAL STEEL	LUMP	LUMP			.
0680	SPV.0105 SPECIAL 48. STEEL FLOOR DECKING	LUMP	LUMP			.
0690	SPV.0105 SPECIAL 49. FLOOR GRINDING	LUMP	LUMP			.
0700	SPV.0105 SPECIAL 50. CLEAN TUNNEL DRAIN TILES	LUMP	LUMP			.
0710	SPV.0105 SPECIAL 51. STORM SEWER INSTALLATION AND ALTERATION	LUMP	LUMP			.
0720	SPV.0105 SPECIAL 52. EROSION CONTROL AND INLET PROTECTION	LUMP	LUMP			.
0730	SPV.0105 SPECIAL 53. SEDIMENT TANK	LUMP	LUMP			.
0740	SPV.0105 SPECIAL 54. SHED DEMOLITION	LUMP	LUMP			.
0750	SPV.0105 SPECIAL 55. STEAM PIPE DEMOLITION AND ALTERATION	LUMP	LUMP			.

CONTRACT: 20140513019 PROJECT(S): 1000-40-70 FEDERAL ID(S): WISC 2014176

CONTRACTOR :_____

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	UNIT PRICE CTS	BID AMOUNT DOLLARS	BID AMOUNT CTS
0760	SPV.0105 SPECIAL 56. CONCRETE DEMOLITION	LUMP	LUMP			.
0770	SPV.0105 SPECIAL 57. REMOVE FIRE PROTECTION WATER LINES	LUMP	LUMP			.
0780	SPV.0105 SPECIAL 58. BLOWER AND TUNNEL VENT PIPES DEMOLITION AND ALTERATIONS	LUMP	LUMP			.
0790	SPV.0105 SPECIAL 59. SAWING	LUMP	LUMP			.
0800	SPV.0105 SPECIAL 60. PLATFORM DEMOLITION	LUMP	LUMP			.
0810	SPV.0105 SPECIAL 61. HANDRAIL REMOVAL	LUMP	LUMP			.
0820	SPV.0105 SPECIAL 62. ASPHALT PLACEMENT AND RESTORATION	LUMP	LUMP			.
0830	SPV.0105 SPECIAL 63. COLUMN FOUNDATION MONITORING	LUMP	LUMP			.
0840	SPV.0105 SPECIAL 64. ALUMINUM WINDOWS	LUMP	LUMP			.
0850	SPV.0105 SPECIAL 65. BALLAST MAT	LUMP	LUMP			.
0860	SPV.0195 SPECIAL 01. DIRECT LANDFILL	2,900.000 TON	.			.
	SECTION 0001 TOTAL					.
	TOTAL BID					.

PLEASE ATTACH SCHEDULE OF ITEMS HERE