CONTRACT TECHNICAL SPECIFICATIONS
FOR
FAYETTE COUNTY COURTHOUSE
CONFERENCE ROOM EXPANSION

61 EAST MAIN STREET
UNIONTOWN, PA 15401

Bid Contract No. 20-04

August 2020

Prepared For:
Fayette County
Board of Commissioners
61 East Main Street
Uniontown, PA 15401
724-430-1200

Prepared By:
McMillen Engineering, Inc.
Civil Engineers/Land Surveyors
115 Wayland Smith Drive
Uniontown, PA 15401
Phone 724-439-8110

A D V E R T I S E M E N T

Sealed bids will be received in the Fayette County Office of Controller, Fayette County Courthouse, Pennsylvania, until 3:00PM, Thursday, September 10, 2020 for the bids for:

- Bid No. 20-04 Fayette County Courthouse Conference Room Expansion
- Bid No. 20-07 Fayette County Courthouse Public Defender Office
- Bid No. 20-08 Fayette County Courthouse District Attorney Office

All three offices are located at 61 East Main Street, Uniontown, Pennsylvania 15401. The engineer is McMillen Engineering, Inc.,115 Wayland Smith Drive, Uniontown, PA 15401, Telephone 724-439-8110, Fax 724-439-4733.

Bid Forms and Specifications are on file and may be examined at the offices of the Fayette County Commissioners and McMillen Engineering, Inc.

An electronic copy of the contract documents must be obtained from McMillen Engineering, Inc.

All bids submitted to this advertisement must be sealed with clear tape and clearly marked on the outside of the envelope the required Bid Number. Any contractor who desires to submit for all projects must submit a separate sealed bid for each project.

A mandatory pre-bid meeting will be held at the Fayette County Courthouse on Thursday, September 3rd at 9:00AM. Interested Bidders are to meet in front of the Main Entrance.

Submit one (1) original and five (5) copies to the Office of the County Controller, Courthouse, 61 East Main Street, Uniontown, Pennsylvania 15401.

The Fayette County Commissioners reserve the right to reject any or all bids or parts thereof.

Scott Abraham
Fayette County Controller

Advertise: August 28, 2020 and September 1, 2020
Open: September 10, 2020

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ATTACHMENT 1
INFORMATION FOR BIDDERS

BIDS will be received by the County of Fayette (herein called the "Owner"), until 3:00PM, Thursday, September 10, 2020 at the **Office of the County Controller, Fayette County, 61 East Main Street, Uniontown, PA 15401**, and then publicly open and read aloud at the Fayette County Commissioners Conference Room.

Each BID must be submitted in a sealed envelope, addressed to the Office of the County Controller, Fayette County, 61 East Main Street, Uniontown, PA 15401. Each sealed (clear tape) envelope containing a BID must be plainly marked on the outside of the envelope as BID NO. 20-04 and the envelope should bear on the outside the Bidder's name and address. If forwarded by mail, the sealed (clear tape) envelope containing the BID must be enclosed in another envelope (sealed with clear tape) addressed to the Owner at:

> Office of the County Controller, Fayette County, 61 East Main Street, Uniontown, PA 15401

ALL BIDS must be made on the required BID form (Attachment 2). All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted. One (1) original and five (5) copies of the Bid Form are to be submitted.

The Owner may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. The award of the Contract and the issuance of Notice to Proceed shall be contingent upon the approval of the Performance Bond, Payment Bond, Agreement, and the Certificates of Insurance.

The Owner shall award the contract to the lowest responsible Bidder or shall reject all BIDS within 60 days of the date of the BID opening, and no Bidder may withdraw a BID before the expiration of such 60-day period; PROVIDED, however, that if the award of contract is delayed by a required approval of another government agency, the sale of bonds, of the award of a grant or grants, the Owner shall reject all BIDS or award the contract within 120 days of the date of BID opening, and no Bidder may withdraw a BID before the expiration of such 120-day period. Thirty (30) day extensions of this date for the award of the contract may be made by the mutual written consent of the Owner and the Bidders.

Bidders must satisfy themselves of the accuracy of the estimated quantities in the BID Schedule by examination of the site and a review of the drawings and specifications including ADDENDA. After BIDS have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the Owner or any other person shall not affect the risks fulfilling any of the conditions of the Contract.

Each BID must be accompanied by a BID bond payable to the Owner for ten percent of the total amount of the BID. As soon as the BID prices have been compared, the Owner will return the BONDS of all except the three lowest responsible Bidder. When the Agreement is executed these bonds also will be returned.

A performance BOND and a payment BOND each in the amount of 100 percent of the CONTRACT PRICE, with a corporate surety approved by the Owner, will be required for the faithful performance of the contract. All bonds shall be furnished on the forms included in the Contract Documents. No other forms shall be accepted.

Attorneys-in-fact who sign BID BONDS or payment BONDS and performance BONDS must file with each BOND a certified and effective dated copy of their power of attorney.

The party to whom the Notice of Intent to Award is given will be required to obtain the performance BOND and payment BOND within ten (10) calendar days from the date of receipt of the NOTICE OF INTENT TO AWARD. The NOTICE OF INTENT TO AWARD shall be accompanied by the necessary BOND forms. In case of failure of the Bidder to execute and deliver the BONDS, the Owner may at his option consider the Bidder in default, in which case the BID BOND accompanying the proposal shall become the Property of the Owner.

Within ten (10) calendar days after the approval of the BONDS, by the Owner, the Owner will issue the NOTICE OF AWARD. The NOTICE OF AWARD shall be accompanied by the necessary Agreement form. The party to whom the NOTICE OF AWARD is given will be required to execute the Agreement and deliver it together with the Certificates of Insurance to the Owner within ten (10) calendar days from the date when the NOTICE OF AWARD is delivered to the Bidder. In case of the failure of the Bidder to execute the Agreement, the Owner may at his option consider the Bidder to be in default in which case the BID BOND accompanying the proposal shall become the property of the Owner.

The NOTICE TO PROCEED shall be issued to the Contractor within thirty (30) days of the AWARD OF THE CONTRACT unless the time is extended by mutual written consent of the Owner and the CONTRACTOR. In case the Performance Bond, Payment Bond, Agreement and/or the Certificates of Insurance submitted by the Bidder do not meet the requirements of the Contract Documents and changes are to be made before it can be accepted by the Owner, the Bidder is obligated to accept an extension of the DATE OF AWARD of the CONTRACT and/or the DATE OF ISSUE of NOTICE TO PROCEED for that period of additional time required to furnish acceptable documents.

The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any BID if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the WORK contemplated therein.

A conditional or qualified BID will not be accepted.

Award will be made to the lowest responsible Bidder, and in the best interest of the Owner.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT shall apply to the contract throughout.

Each Bidder is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to its BID.

The low Bidder shall supply the names and addresses of major material SUPPLIERS and SUB-CONTRACTORS when required to do so by the Owner.

ATTACHMENT 2A
BID FORM (GENERAL)

Proposal of _____
Hereinafter called "Bidder", organized and existing under the laws of the State of
" _____" doing business as _____

To the County of Fayette hereinafter called "Owner".

In compliance with your Advertisement for Bids, Bidder hereby proposes to perform all work for the construction of the "Fayette County Courthouse Conference Room Expansion" in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each Bidder certifies, and in the case of a joint BID each party thereto certifies as to its own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other Bidder or with any competitor.

Bidder hereby agrees to commence work under this contract on or before a date to be specified in the NOTICE TO PROCEED and to fully complete the PROJECT by December 15, 2020. Time is of the essence. No payment shall be made for work not completed. Bidder further agrees to pay as liquidated damages, the sum of the $2,000.00 for each consecutive calendar day thereafter.

Bidder acknowledges receipt of the following ADDENDUM:

_____
_____
_____
_____

Bidder agrees to perform all the work described in the CONTRACT DOCUMENTS for the following price:

Base Bid General Contractor

Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	General Construction	1	LS		
Total Base Bid					

One (1) original and five (5) copies of the Bid Form are to be submitted.

Respectfully submitted:

Signature	Address
Title	Date
License number (if applicable)	

SEAL – (if BID is by a corporation)

ATTACHMENT 2B
BID FORM (ELECTRICAL)

Proposal of _____
Hereinafter called "Bidder", organized and existing under the laws of the State of
" _____" doing business as _____

To the County of Fayette hereinafter called "Owner".

In compliance with your Advertisement for Bids, Bidder hereby proposes to perform all work for the construction of the "Fayette County Courthouse Conference Room Expansion" in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each Bidder certifies, and in the case of a joint BID each party thereto certifies as to its own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other Bidder or with any competitor.

Bidder hereby agrees to commence work under this contract on or before a date to be specified in the NOTICE TO PROCEED and to fully complete the PROJECT by December 15, 2020. Time is of the essence. No payment shall be made for work not completed. Bidder further agrees to pay as liquidated damages, the sum of the $2,000.00 for each consecutive calendar day thereafter.

Bidder acknowledges receipt of the following ADDENDUM:

_____
_____
_____
_____

Bidder agrees to perform all the work described in the CONTRACT DOCUMENTS for the following price:

Base Bid Electrical

Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	Electrical	1	LS		
Total Base Bid					

One (1) original and five (5) copies of the Bid Form are to be submitted.

Respectfully submitted:

Signature	Address
Title	Date
License number (if applicable)	

SEAL – (if BID is by a corporation)

ATTACHMENT 2C
BID FORM (PLUMBING)

Proposal of _____
Hereinafter called "Bidder", organized and existing under the laws of the State of
" _____" doing business as _____

To the County of Fayette hereinafter called "Owner".

In compliance with your Advertisement for Bids, Bidder hereby proposes to perform all work for the construction of the "Fayette County Courthouse Conference Room Expansion" in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each Bidder certifies, and in the case of a joint BID each party thereto certifies as to its own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other Bidder or with any competitor.

Bidder hereby agrees to commence work under this contract on or before a date to be specified in the NOTICE TO PROCEED and to fully complete the PROJECT by December 15, 2020. Time is of the essence. No payment shall be made for work not completed. Bidder further agrees to pay as liquidated damages, the sum of the $2,000.00 for each consecutive calendar day thereafter.

Bidder acknowledges receipt of the following ADDENDUM:

_____
_____
_____
_____

Bidder agrees to perform all the work described in the CONTRACT DOCUMENTS for the following price:

Base Bid Plumbing

Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	Plumbing	1	LS		
Total Base Bid					

One (1) original and five (5) copies of the Bid Form are to be submitted.

Respectfully submitted:

Signature	Address
Title	Date
License number (if applicable)	

SEAL – (if BID is by a corporation)

ATTACHMENT 3
BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,
_____as Principal, and
_____as Surety, are hereby held and firmly bound unto
_____as Owner in the penal sum of
_____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of _____.

The Condition of the above obligation is such that whereas the Principal has submitted to _____ _____ a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing, for the _____

NOW, THEREFORE,

(a) If said BID shall be rejected, or
(b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attachment hereto (Properly completed in accordance with said BID) and shall furnish a BOND for faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the Owner may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____
Principal

_____
Surety

By: _____
IMPORTANT – Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and authorized to transact business in Pennsylvania.

ATTACHMENT 4
AGREEMENT

THIS AGREEMENT, made this _____ day of _____, by and between County of Fayette, hereinafter called "Owner"

And _____ doing business as (an individual,) or (a partnership,) or (a corporation) hereinafter called "Contractor".

WITNESSETH: That for and in consideration of the payments and agreements herein after mentioned:

1. The CONTRACTOR will commence and complete the construction of the Fayette County Courthouse Conference Room Expansion, also called "Project".

2. The CONTRACTOR will furnish all of the materials, supplies, tools, equipment, labor, and other services necessary for the construction and completion of the PROJECT described herein.

3. The CONTRACTOR will commence the work required by the CONTRACT DOCUMENTS within 10 calendar days or as directed by contract documents after the date of the NOTICE TO PROCEED and will complete the construction by December 15, 2020.

4. The CONTRACTOR agrees to perform all of the work described in the CONTRACT DOCUMENTS and comply with terms therein for the sum of $_____or as shown in the BID Schedule for the Base Bid.

5. The term "CONTRACT DOCUMENTS" means and includes the following:

1. "Contract Documents dated August 2020 Fayette County Courthouse Conference Room Expansion"
2. Drawings by McMillen Engineering, Inc. dated August 2020 and called Fayette County Courthouse Conference Room Expansion
3. All Supplemental Specifications, Lot-sheets and similar specifically referenced/acknowledged in Attachment 2-Bid Form.

6. The Owner will pay to the CONTRACTOR in the manner and at such times as set forth in the General Conditions such amounts as required by the CONTRACT DOCUMENTS.

7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

IN WITNESS WHEREOF, the parties hereto have executed or caused to be executed by their duly authorized official, this Agreement in Five (5) copies each of which shall be deemed an original on the date first above written.

Owner:

County of Fayette

By _____ _____ _____

Name _____ _____ _____

Title _____ _____ _____

(Seal)

ATTEST:

_____

Name _____

Title _____

CONTRACTOR:

_____

By _____

Name _____

Address _____

_____

Employer Identification Number _____

(Seal)

ATTEST:

_____

Name _____

Title _____

ATTACHMENT 5
PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS: that

_____
(Name of Contractor)

_____
(Address of Contractor)

A_____, hereinafter called Principal, and
(Corporation, Partnership, or Individual)

_____
(Name of Surety)

_____
(Address of Surety)

Hereinafter called Surety, are held and firmly bound unto

_____
(Name of Owner)

_____
(Address of Owner)

Hereinafter called Owner in the total aggregate penal sum of _____
Dollars ($_____)

In lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal submitted a certain bid to the Owner, dated the_____day of _____a copy of which is hereto attached and made a part hereof and intends to enter into a certain agreement with the Owner for the construction of:

_____

_____

_____

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the SURETY and during the one year guaranty period and if the PRINCIPAL shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said SURETY, for value received hereby stipulates and agrees that no change, extensions of time, alteration or addition to the terms of the contract or to WORK to be performed there under or the SPECIFICATIONS accompanying same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that it is expressly agreed that the BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performances of the CONTRACT as so amended. The term "Amendment", wherever used in this BOND, and whether referring to this BOND, the Contract or the Loan modification of any character whatsoever.

PROVIDED, FURTHER, that no final settlement between the Owner and the PRINCIPAL shall abridge the right of the other beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in Five (5) Counterparts, each of which shall be deemed an original, each with an original power of attorney, this the _____day of _____ _____.

ATTEST:

_____Principal

_____
(Principal) Secretary

(SEAL)

By _____(s)

_____

_____
(Address)

_____
Witness as to Principal

_____
(Address)

_____ _____
Surety

ATTEST:

_____ By _____
Witness to Surety Attorney-in-Fact

_____ _____
(Address) (Address)

_____ _____

NOTE: Date of BOND must not be prior to date of NOTICE OF INTENT TO AWARD. If CONTRACTOR is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state of Pennsylvania.

ATTACHMENT 6
PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENTS: that

_____
Name of Contractor

_____
Address of Contractor

A _____hereinafter called PRINCIPAL and (Corporation, Partnership or Individual)

_____
Name of Surety

Hereinafter called Surety, are held and firmly bound unto

_____
Name of Owner

_____
Address of Owner

hereinafter called Owner and unto all persons, firms, and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns in the total aggregate penal sum of _____Dollars ($_____ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL submitted a certain bid to the Owner, dated the _____day of _____ a copy of which is hereto attached and made a part hereof, and intends to enter into a certain agreement with the Owner for the construction of:

_____

_____

_____

NOW, THEREFORE, if the PRINCIPAL shall promptly make payment to all persons, firms, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extensions or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and for all labor cost incurred in such WORK including that by a SUBCONTRACTOR, and to any mechanic or materialman lienholder whether it acquires its lien by operation of State or Federal law; then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, that beneficiaries or claimants hereunder shall be limited to the SUBCONTRACTORS, and persons, firms, and corporations having a direct contract with the PRINCIPAL or its SUBCONTRACTORS.

PROVIDED, FURTHER, that the said SURETY for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the WORK or to the SPECIFICATIONS.

PROVIDE, FURTHER, that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL shall have given written notice to any two of the following: The PRINCIPAL, the Owner, or the Surety above named within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepared, in an envelope addressed to the PRINCIPAL, Owner, OR SURETY, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer. (b) After the expiration of one (1) year following the date of which PRINCIPAL ceased work on said CONTRACT, is being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

PROVIDED, FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

PROVIDED, FURTHER, that no final settlement between the Owner and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in Five (5) Counterparts, each of which shall be deemed an original, each with an original power of attorney, this the _____day of _____ _____.

ATTEST:

_____Principal

_____
(Principal) Secretary

(SEAL)

By _____(s)

_____

_____
(Address)

_____
Witness as to Principal

_____
(Address)

_____ _____
Surety

ATTEST:

_____ By _____
Witness to Surety Attorney-in-Fact

_____ _____
(Address) (Address)

_____ _____

NOTE: Date of BOND must not be prior to date of NOTICE OF INTENT TO AWARD. If CONTRACTOR is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state of Pennsylvania.

ATTACHMENT 7
NOTICE OF INTENT TO AWARD

To: _____
Contractor

_____
Address

Gentlemen:

You are the Bidder selected for the construction of the_____for the County of Fayette Pursuant to the Specification under which your Proposal was submitted you are hereby notified that the Owner represented by the undersigned intends to award a Contract to you for the aforesaid work. The Contract Price is computed to be **$**_____, on the basis of the acceptance of your proposal for the Base Bid.

Enclosed herewith are copies of the required Performance BOND and Payment Bond to be executed by the Contracting Party and by an approved corporate surety, as required by the Specifications. These bonds may bear any date on or after your receipt of this notice and must be accompanied by proper powers of attorney from the corporate surety, bearing the same date as the BONDS. The BONDS shall be executed in Five (5) counterparts, each of which shall be deemed an original, each with an original power of attorney, and returned to the undersigned within ten (10) days after receipt of this letter.

The BONDS must be supplied before an award of the Contract can be made to you.

If you fail to execute and deliver the BONDS within the time specified, you shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with your Proposal.

Dated this ___ day of _____.

County of Fayette
Owner

By _____ _____ _____

Title _____ _____ _____

ACCEPTANCE OF NOTICE

Receipt of the above Intent of Award is hereby acknowledged this the ___ day of _____

By _____

ATTACHMENT 8
NOTICE OF AWARD

To: _____
_____
_____

PROJECT Description: _____

The Owner has considered the BID submitted by you for the above described WORK in response to its Advertisement for the Bids dated _____, and information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of $_____ for the Base Bid.

You are required by the Information for Bidders to execute the Agreement and furnish the required certificates of insurance within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement within ten (10) days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your BID as abandoned and as a forfeiture of your BID BOND. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the Owner.

Dated this _____ day of _____.

County of Fayette
Owner

By _____ _____ _____

Title _____ _____ _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged

By _____ this the _____ day of _____

By _____

Title _____

ATTACHMENT 9
NOTICE TO PROCEED

To:_____ Date: _____
_____ Project: _____
_____

You are hereby notified to commence WORK in accordance with the Agreement dated _____ on or before _____, and you are to complete the WORK no later than December 15, 2020.

County of Fayette
Owner

By _____ _____ _____

Title _____ _____ _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by

_____

This the _____ day of _____

By _____

Title _____

Employer Identification Number _____

Contractor's Application for Payment No. _____

	Application Period:	Application Date:
To (Owner):	From (Contractor):	Via (Engineer):
Project:	Contract:	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.:

Application For Payment

Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

1.	**ORIGINAL CONTRACT PRICE**	$ _____
2.	**Net change by Change Orders**	$ _____
3.	**Current Contract Price (Line 1 ± 2)**	$ _____
4.	**TOTAL COMPLETED AND STORED TO DATE (Column F on Progress Estimate)**	$ _____
5.	**RETAINAGE:**	
	a. _____ X _____ **Work Completed**	$ _____
	b. _____ X _____ **Stored Material**	$ _____
	c. **Total Retainage (Line 5a + Line 5b)**	$ _____
6.	**AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5c)**	$ _____
7.	**LESS PREVIOUS PAYMENTS (Line 6 from prior Application)**	$ _____
8.	**AMOUNT DUE THIS APPLICATION**	$ _____
9.	**BALANCE TO FINISH, PLUS RETAINAGE (Column G on Progress Estimate + Line 5 above)**	$ _____

Contractor's Certification

The undersigned Contractor certifies that to the best of its knowledge: (1) all previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to Owner indemnifying Owner against any such Liens, security interest or encumbrances); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

By:	Date:

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is recommended by: _____ _____
(Engineer) (Date)

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is approved by: _____ _____
(Owner) (Date)

Approved by: _____ _____
Funding Agency (if applicable) (Date)

Endorsed by the Construction Specifications Institute.

Application for Payment, EJCDC C-620
Prepared by the Engineers Joint Contract Documents Committee

Attachment 10-1

Fayette County Board of Commissioners
Fayette County Courthouse Conference Room Expansion
Bid Contract No. 20-04

Progress Estimate

Contractor's Application

For (contract):		Application Number:							
Application Period:		Application Date:							
A		B	C	D	E	F		G
Item		Scheduled Value	Work Completed		Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F) B	Balance to Finish (B - F)
Specification Section No.	Description		From Previous Application (C+D)	This Period				
	Totals							

Progress Estimate

Contractor's Application

For (contract):											Application Number:		
Application Period:											Application Date:		
A					B	C	D	E	F				
Item													
Bid Item No.	Description	Bid Quantity	Unit Price	Bid Value	Estimated Quantity Installed	Value	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F) B	Balance to Finish (B - F)			
	Totals												

Stored Material Summary

Contractor's Application

For (contract): | Application Number:

Application Period: | Application Date:

A	B	C	D		E		F		G
Invoice No.	Shop Drawing Transmittal No.	Materials Description	Stored Previously		Stored this Month		Incorporated in Work		Materials Remaining in Storage ($) (D + E - F)
			Date (Month/Year)	Amount ($)	Amount ($)	Subtotal	Date (Month/Year)	Amount ($)	
		Totals							

ATTACHMENT 11
CHANGE ORDER
No. __

Date of Issuance: _____ Effective Date: _____

Project:	Owner: Fayette County	Owner's Contract No.:
Contract:		Date of Contract:
Contractor:		Engineer's Project No.:

The Contract Documents are modified as follows upon execution of this Change Order:

Description:

_____

_____

Attachments (list documents supporting change):

_____

CHANGE IN CONTRACT PRICE:	**CHANGE IN CONTRACT TIMES:**
Original Contract Price: $_____	Original Contract: ☐ Working days ☐ Calendar days Substantial completion (days or date): _____ Ready for final payment (days or date): _____
[Increase] [Decrease] from previously approved Change Orders No. to No. : $_____	[Increase] [Decrease] from previously approved Change Orders No. to No. : Substantial completion (days): _____ Ready for final payment (days): _____
Contract Price prior to this Change Order: $_____	Contract Times prior to this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
[**Increase**] [Decrease] of this Change Order: $_____	[Increase] [Decrease] of this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
Contract Price incorporating this Change Order: $_____	Contract Times with all approved Change Orders: Substantial completion (days or date): _____ Ready for final payment (days or date): _____

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable):

_____ Date: _____

Change Order Form, EJCDC C-941
Prepared by the Engineers Joint Contract Documents Committee

CHANGE ORDER
INSTRUCTIONS

GENERAL INFORMATION

This document was developed to provide a uniform format for handling contract changes that affect Contract Price or Contract Times. Changes that have been initiated by a Work Change Directive must be incorporated into a subsequent Change Order if they affect Price or Times.

Changes that affect Contract Price or Contract Times should be promptly covered by a Change Order. The practice of accumulating Change Orders to reduce the administrative burden may lead to unnecessary disputes.

If Milestones have been listed in the Agreement, any effect of a Change Order thereon should be addressed.

For supplemental instructions and minor changes not involving a change in the Contract Price or Contract Times, a Field Order should be used.

COMPLETING THE CHANGE ORDER FORM

Engineer normally initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by Contractor, or requests from Owner, or both.

Once Engineer has completed and signed the form, all copies should be sent to Owner or Contractor for approval, depending on whether the Change Order is a true order to the Contractor or the formalization of a negotiated agreement for a previously performed change. After approval by one contracting party, all copies should be sent to the other party for approval. Engineer should make distribution of executed copies after approval by both parties.

If a change only applies to price or to times, cross out the part of the tabulation that does not apply.

Attachment 12
Davis Bacon Wage Rates

"General Decision Number: PA20200089 07/24/2020

Superseded General Decision Number: PA20190089

State: Pennsylvania

Construction Type: Building

County: Fayette County in Pennsylvania.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.80 for calendar year 2020 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.80 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2020. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2020
1	02/07/2020
2	03/13/2020
3	04/17/2020
4	06/05/2020
5	06/19/2020
6	07/03/2020
7	07/24/2020

ASBE0002-005 08/01/2019

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR		
MECHANICAL- Duct, Pipe & Mechanical System Insulation and Industrial Work (Including Duct and Pipe)	$ 41.26	25.67

BOIL0154-007 01/01/2017

	Rates	Fringes

BOILERMAKER.....$ 40.90 27.27

BRPA0009-011 12/01/2019

	Rates	Fringes
TILE FINISHER	$ 26.00	15.86
TILE SETTER	$ 31.91	20.24

BRPA0009-050 06/01/2019

	Rates	Fringes
BRICKLAYER (Including Pointing, Caulking, Cleaning and Brick Refractory Work)	$ 32.35	22.26
MASON - STONE	$ 32.35	22.26

Additional $0.75 to the base wage for Brick Refractory work

CARP0142-013 06/01/2020

	Rates	Fringes
CARPENTER (Including Acoustical Ceiling Installation, Drywall Hanging, Metal Stud Installation, Floor Laying-Hardwood, Carpet and Vinyl; Form Work, and Scaffold Building)	$ 35.48	18.31

CARP0443-004 06/01/2020

	Rates	Fringes
MILLWRIGHT	$ 41.68	19.97

CARP2235-007 01/01/2020

	Rates	Fringes
PILEDRIVERMAN	$ 35.40	19.70

ELEC0005-016 12/22/2019

	Rates	Fringes
ELECTRICIAN (Includes Alarm Installation, Installation of Sound and Communication System, Low Voltage Wiring and HVAC Temperature Control Installation)	$ 42.61	27.19

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* ENGI0066-040 06/12/2017

	Rates	Fringes
POWER EQUIPMENT OPERATOR Backhoe/Excavator/Trackhoe, Bobcat/Skid Steer/Skid Loader, Bulldozer,		

Compactor, Crane*, Drill
Rig Caissons, Drill,
Gradall, Grader/Blade, Man
Lift/Outside Elevator,
Mechanic, Paver (Asphalt,
Aggregate, and Concrete),
Scraper, Forklift (Lull)....$ 34.49 20.15
Broom/Sweeper,
Compressor, Concrete Pump,
Highlift, Hoist, Pump,
Roller, Tugboat, Forklift
(ridden or self-propelled)..$ 29.58 20.15
Loader.....$ 34.49 20.15
Oiler.....$ 27.25 20.15

*Add to Crane rate:

Booms 101-150 jibs- Add $.75
Booms 151-200 jibs- Add $1.50
Booms 201-251 jibs- Add $2.25

ENGI0066-051 06/12/2017

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
Loader	$ 29.58	20.15

IRON0003-021 06/01/2020

	Rates	Fringes
IRONWORKER (Metal Roof Installation, Ornamental, Reinforcing, Rigger and Structural; Metal Buildings: Metal Siding/Wall Panels Installation)	$ 37.29	32.40

LABO0125-005 06/01/2014

	Rates	Fringes
LABORER		
Mason Tender - Cement/Concrete	$ 24.34	9.75

LABO0286-001 01/01/2015

	Rates	Fringes
LABORER (Mason Tender- Brick)	$ 22.17	13.65

LABO0373-001 01/01/2017

	Rates	Fringes
LABORER (Asbestos Abatement (Removal from Floors, Walls, and Ceilings))	$ 22.60	15.44

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* PAIN0057-033 06/01/2020

	Rates	Fringes

PAINTER (Brush, Roller, and Spray, excluding work on Industrial sites).....$ 28.80 20.72
PAINTER (Drywall Finishing/Taping).....$ 30.10 20.50

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* PAIN0057-034 06/01/2020

	Rates	Fringes
PAINTER (INDUSTRIAL: Brush and Roller Only).....	$ 33.55	20.72
PAINTER (INDUSTRIAL: Spray and Sandblaster Only).....	$ 33.55	20.72

PAIN0751-006 09/01/2019

	Rates	Fringes
GLAZIER.....	$ 30.50	24.11

PLAS0031-016 06/01/2015

	Rates	Fringes
PLASTERER.....	$ 27.97	14.26

PLAS0526-015 06/01/2019

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 31.27	19.39

PLUM0354-010 06/01/2017

	Rates	Fringes
PIPEFITTER (Industrial).....	$ 37.88	22.90

PLUM0354-017 06/01/2017

	Rates	Fringes
PLUMBER (Includes HVAC Pipe Installation).....	$ 33.83	22.90

PLUM0449-007 06/01/2020

	Rates	Fringes
PIPEFITTER (Excludes Work on Industrial Sites).....	$ 42.25	24.82

ROOF0037-004 06/01/2020

	Rates	Fringes
ROOFER (Includes Waterproofing, Excludes Metal Roof Installation).....	$ 32.17	17.75

SFPA0669-004 04/01/2020

	Rates	Fringes

SPRINKLER FITTER (Fire
Sprinklers).....$ 38.90 26.17

SHEE0012-010 07/01/2020

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation).....	$ 37.96	28.05

SUPA2011-047 08/20/2014

	Rates	Fringes
LABORER: Asphalt Raker.....	$ 20.92	9.09
LABORER: Common or General.....	$ 20.92	9.27
LABORER: Landscape.....	$ 18.10	0.00
LABORER: Luteman.....	$ 21.13	8.23
TRUCK DRIVER: Dump Truck.....	$ 23.36	7.60

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate

(weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

===

END OF GENERAL DECISION"

Attachment 13
Equal Employment Opportunity Poster

Equal Employment Opportunity is

THE LAW

Private Employers, State and Local Governments, Educational Institutions, Employment Agencies and Labor Organizations

Applicants to and employees of most private employers, state and local governments, educational institutions, employment agencies and labor organizations are protected under Federal law from discrimination on the following bases:

RACE, COLOR, RELIGION, SEX, NATIONAL ORIGIN

Title VII of the Civil Rights Act of 1964, as amended, protects applicants and employees from discrimination in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment, on the basis of race, color, religion, sex (including pregnancy), or national origin. Religious discrimination includes failing to reasonably accommodate an employee's religious practices where the accommodation does not impose undue hardship.

DISABILITY

Title I and Title V of the Americans with Disabilities Act of 1990, as amended, protect qualified individuals from discrimination on the basis of disability in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment. Disability discrimination includes not making reasonable accommodation to the known physical or mental limitations of an otherwise qualified individual with a disability who is an applicant or employee, barring undue hardship.

AGE

The Age Discrimination in Employment Act of 1967, as amended, protects applicants and employees 40 years of age or older from discrimination based on age in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment.

SEX (WAGES)

In addition to sex discrimination prohibited by Title VII of the Civil Rights Act, as amended, the Equal Pay Act of 1963, as amended, prohibits sex discrimination in the payment of wages to women and men performing substantially equal work, in jobs that require equal skill, effort, and responsibility, under similar working conditions, in the same establishment.

GENETICS

Title II of the Genetic Information Nondiscrimination Act of 2008 protects applicants and employees from discrimination based on genetic information in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment. GINA also restricts employers' acquisition of genetic information and strictly limits disclosure of genetic information. Genetic information includes information about genetic tests of applicants, employees, or their family members; the manifestation of diseases or disorders in family members (family medical history); and requests for or receipt of genetic services by applicants, employees, or their family members.

RETALIATION

All of these Federal laws prohibit covered entities from retaliating against a person who files a charge of discrimination, participates in a discrimination proceeding, or otherwise opposes an unlawful employment practice.

WHAT TO DO IF YOU BELIEVE DISCRIMINATION HAS OCCURRED

There are strict time limits for filing charges of employment discrimination. To preserve the ability of EEOC to act on your behalf and to protect your right to file a private lawsuit, should you ultimately need to, you should contact EEOC promptly when discrimination is suspected:

The U.S. Equal Employment Opportunity Commission (EEOC), 1-800-669-4000 (toll-free) or 1-800-669-6820 (toll-free TTY number for individuals with hearing impairments). EEOC field office information is available at www.eeoc.gov or in most telephone directories in the U.S. Government or Federal Government section. Additional information about EEOC, including information about charge filing, is available at www.eeoc.gov.

Employers Holding Federal Contracts or Subcontracts

Applicants to and employees of companies with a Federal government contract or subcontract are protected under Federal law from discrimination on the following bases:

RACE, COLOR, RELIGION, SEX, NATIONAL ORIGIN

Executive Order 11246, as amended, prohibits job discrimination on the basis of race, color, religion, sex or national origin, and requires affirmative action to ensure equality of opportunity in all aspects of employment.

INDIVIDUALS WITH DISABILITIES

Section 503 of the Rehabilitation Act of 1973, as amended, protects qualified individuals from discrimination on the basis of disability in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment. Disability discrimination includes not making reasonable accommodation to the known physical or mental limitations of an otherwise qualified individual with a disability who is an applicant or employee, barring undue hardship. Section 503 also requires that Federal contractors take affirmative action to employ and advance in employment qualified individuals with disabilities at all levels of employment, including the executive level.

DISABLED, RECENTLY SEPARATED, OTHER PROTECTED, AND ARMED FORCES SERVICE MEDAL VETERANS

The Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, 38 U.S.C. 4212, prohibits job discrimination and requires affirmative action to employ and advance in employment disabled veterans, recently separated veterans (within three years of discharge or release from active duty), other protected veterans (veterans who served during a war or in a campaign or expedition for which a campaign badge has been authorized), and Armed Forces service medal veterans (veterans who, while on active duty, participated in a U.S. military operation for which an Armed Forces service medal was awarded).

RETALIATION

Retaliation is prohibited against a person who files a complaint of discrimination, participates in an OFCCP proceeding, or otherwise opposes discrimination under these Federal laws.

Any person who believes a contractor has violated its nondiscrimination or affirmative action obligations under the authorities above should contact immediately:

The Office of Federal Contract Compliance Programs (OFCCP), U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210, 1-800-397-6251 (toll-free) or (202) 693-1337 (TTY). OFCCP may also be contacted by e-mail at OFCCP-Public@dol.gov, or by calling an OFCCP regional or district office, listed in most telephone directories under U.S. Government, Department of Labor.

Programs or Activities Receiving Federal Financial Assistance

RACE, COLOR, NATIONAL ORIGIN, SEX

In addition to the protections of Title VII of the Civil Rights Act of 1964, as amended, Title VI of the Civil Rights Act of 1964, as amended, prohibits discrimination on the basis of race, color or national origin in programs or activities receiving Federal financial assistance. Employment discrimination is covered by Title VI if the primary objective of the financial assistance is provision of employment, or where employment discrimination causes or may cause discrimination in providing services under such programs. Title IX of the Education Amendments of 1972 prohibits employment discrimination on the basis of sex in educational programs or activities which receive Federal financial assistance.

INDIVIDUALS WITH DISABILITIES

Section 504 of the Rehabilitation Act of 1973, as amended, prohibits employment discrimination on the basis of disability in any program or activity which receives Federal financial assistance. Discrimination is prohibited in all aspects of employment against persons with disabilities who, with or without reasonable accommodation, can perform the essential functions of the job.

If you believe you have been discriminated against in a program of any institution which receives Federal financial assistance, you should immediately contact the Federal agency providing such assistance.

"EEO is the Law" Poster Supplement

Employers Holding Federal Contracts or Subcontracts Section Revisions

The Executive Order 11246 section is revised as follows:

RACE, COLOR, RELIGION, SEX, SEXUAL ORIENTATION, GENDER IDENTITY, NATIONAL ORIGIN

Executive Order 11246, as amended, prohibits employment discrimination based on race, color, religion, sex, sexual orientation, gender identity, or national origin, and requires affirmative action to ensure equality of opportunity in all aspects of employment.

PAY SECRECY

Executive Order 11246, as amended, protects applicants and employees from discrimination based on inquiring about, disclosing, or discussing their compensation or the compensation of other applicants or employees.

The Individuals with Disabilities section is revised as follows:

INDIVIDUALS WITH DISABILITIES

Section 503 of the Rehabilitation Act of 1973, as amended, protects qualified individuals with disabilities from discrimination in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment. Disability discrimination includes not making reasonable accommodation to the known physical or mental limitations of an otherwise qualified individual with a disability who is an applicant or employee, barring undue hardship to the employer. Section 503 also requires that Federal contractors take affirmative action to employ and advance in employment qualified individuals with disabilities at all levels of employment, including the executive level.

The Vietnam Era, Special Disabled Veterans section is revised as follows:

PROTECTED VETERANS

The Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, 38 U.S.C. 4212, prohibits employment discrimination against, and requires affirmative action to recruit, employ, and advance in employment, disabled veterans, recently separated veterans (i.e., within three years of discharge or release from active duty), active duty wartime or campaign badge veterans, or Armed Forces service medal veterans.

Mandatory Supplement to EEOC P/E-1(Revised 11/09) "EEO is the Law" Poster.

If you believe that you have experienced discrimination contact OFCCP: 1-800-397-6251 | TTY 1-877-889-5627 | www.dol.gov.

SECTION 1
INSTRUCTION TO BIDDERS

1.01 **Definitions:** Wherever in these specifications or in other Contract Documents the following works, terms and expressions or pronouns in place of them are used, the intent and meaning shall be interpreted as follow:

Owner: The party of the first part or first party to this Contract, acting directly or through any agent, officer or employee duly authorized to act for the said party in the execution of the work required by this contract.

Engineer: McMillen Engineering, Inc., duly employed by the Owner as consultant, and as an agent authorized to inspect the results of the performance of the work under this Contract by the Contractor. The work "Engineer" shall include the officers, agents and employees of the Engineer.

Contractor: Party of the second part or second party to this contract, acting directly or through his authorized lawful agents, legal representatives, superintendents, or employees, appointed to act for said party in the performance of the work under contract, or the Surety in case of default.

Inspection: The examination of the work performed by the contractor to ascertain its conformity with the contract documents.

Contract: The written agreement executed by and between the Owner and the successful Bidder including collectively all of the contract documents, covering the performance of the work and the furnishing of labor, material and service in the construction of the Project, also any and all supplemental agreements which could be reasonably be required to complete the construction contemplated.

Bidder: Any individual, firm or corporation submitting a proposal for the work contemplated herein, acting directly or through a duly authorized representative.

Proposal or bid: The written offer of a bidder submitted on the approved form prepared for the purpose, to perform the work and to furnish the labor, materials and service embraced in the contract, for the considerations of payment at the prices stated. The entire contents of this volume is a necessary part of the proposal. No documents shall be detached and all addenda, exhibits, whether bound or attached to the Proposal or otherwise, are also a necessary part thereof.

Abbreviations: ACI -American Concrete Institute; ASA -American Standards Association; ASTM -American Society for Testing Materials; AWWA -American Water Works Association; PennDOT -Pennsylvania Department of Transportation; NEMA -National Electrical Manufacturing Association; ANSI -American National Standards Institute; FCC Federal Communications Commission.

"Approved," etc.: The words approved, acceptable, satisfactory, or words of like import, shall mean approved by or acceptable or satisfactory to the engineer, unless another meaning is plainly intended or otherwise specifically stated.

"Required by the Engineer", etc: The words require, prescribed, directed, ordered by the Engineer, or words of like import, shall have the meaning only of interpreting the specifications, or conditions essential to quality of workmanship and work, materials, and finished results necessary to assure conformity to and compliance with the specifications and drawings and are not intended or implied as any directions, instructions or superintendent of the contractor's methods of construction, use of equipment, personnel or safety measures, of precautions or liability therefore by the Owner or engineer.

1.02 **Bidder Responsibility:** The Bidder is required to examine careful, in detail the character of the soil, the site of the project, the contract documents, as defined in these specifications, and all other matters pertinent to the work contemplated. It will be assumed that he has satisfied himself as to the conditions to be encountered overhead, on the surface and underground, the character, quality and quantities of work to be done and materials to be furnished, and the requirements of the contract and specifications. No allowance or concession will be made for the lack of such information on the part of the contractor. Where boring test pits, test piles, and existing underground and overhead structure locations are shown, they are for the information of the Owner only, their correctness is not guaranteed by the Owner or the engineer, and in no event is this information to be considered a part of the contract, or to be used for computations in submitting a proposal.

If this information is used by a Bidder in preparing his proposal, he must assume all risks resulting from conditions differing from the approximation shown. If Bidders desire to obtain such data, the Owner will, to the extent possible afford them the opportunity, at their own expense, to make corings, or soundings, to drive test piles, to dig test pits on the site of the work, and to make measurements and studies of all kinds; where the Owner cannot grant such rights, it will cooperate with the contractor in endeavoring to secure such rights.

There is no expressed or implied agreement that the depths, locations or character of the materials have been correctly indicated and Bidders should take into account that conditions affecting the cost or quantities of work to be done may differ from those indicated.

Bidder shall ascertain all governmental and utility requirements with respect to wage scales, trench and structure excavations, tunnel construction, blasting, equipment, materials, labor, safety and sanitation, and shall base his bid prices on full compliance therewith.

1.03 **Approximate estimate of quantities:** The Bidder's attention is directed to the fact that in contracts based on unit prices the estimate of quantities of work to be done and materials to be furnished under these specifications, as shown on the proposal form, and in the contract, is approximate and is given only for the benefit of the Owner to be used as a basis of calculation upon which to determine the lowest Bidder. Neither the Owner nor the engineer assumes any responsibility that the quantities shall obtain in the construction of the project, nor shall the contractor plead misunderstanding or deception because of such estimate of quantities, or the character of the work or location, or other locations, or other conditions pertaining thereto. The Owner reserves the right to increase or diminish any or all of the above-mentioned quantities of work or to omit any of them as it may deem necessary, and any such increase or decrease of the

quantities given for any of the items shall not be considered as sufficient grounds for granting and increase in the unit prices bid, except as set forth in these specifications.

1.04 **Right to reject proposals:** The unqualified right is reserved by the Owner to waive any informalities in or reject any or all Proposals as may be deemed to be in the best interest of the Owner. Proposals which contain omissions, erasures, alterations, additions not called for, conditional bids or irregularities of any kind, or proposals otherwise regular which are not accompanied by proposal security, may be rejected as informal. Proposals in which the bid prices are obviously unbalanced may be rejected.

1.05 **Changes prior to the opening of bids:** During the period allowed for preparation of bids, the Bidders may be furnished addenda or bulletins for additions to, or alterations of the plans or specifications, which shall be included in the work covered by the proposal and become a part of the contract documents. If any prospective Bidder is in doubt as to the true meaning of any part of the plans, specifications, or other contract documents, he may submit to the Engineer a written request for an interpretation thereof. The Bidder submitting the request will be responsible for its prompt delivery. Any interpretation of the contract documents will be made only by an addendum duly issued and a copy of such addendum will be mailed or delivered to each prospective Bidder of record. The Owner will not be responsible for any other explanations or interpretations of the proposed contract documents.

1.06 **Scope of work :** Unless otherwise provided in the construction specifications or the proposal, it is in the intent of the contract documents to prescribe a complete project which the Bidder proposes to construct, by furnishing all labor, materials, services, equipment, tools, necessary utilities and other facilities, and performing all work necessary or incidental to such construction, in full compliance with the drawings, specification, proposal and contract and any special requirements contained therein, or supplements attached thereto. The Contractor is required to coordinate with Garland Company for protection of the new roof.

Should any construction or conditions be anticipated which is not covered by these specifications, the special requirements thereof will be stated in the proposal and any such special requirements shall be considered a part of these specifications as though they are fully contained herein. If any special requirements stated in the proposal conflicts with any of the provisions of these specifications, the former shall govern.

1.07 **Submitting proposal:** Each Bid must be submitted in a sealed envelope, addressed to Office of County Controller, Fayette County, 61 East Main Street, Uniontown, PA 15401. Each sealed (clear tape) envelope containing a BID must be plainly marked on the outside of the envelope as BID NO 20-04 and the envelope should bear on the outside the Bidder's name and address. If forwarded by mail, the sealed (clear tape) envelope containing the BID must be enclosed in another envelope (sealed with clear tape) addressed to the following owner at: Office of the County Controller, Fayette County, 61 East Main Street, Uniontown, PA 15401. One (1) original and five (5) copies of the Bid Form is to be submitted.

1.08 **Submission of bonds and awards and execution of contract:** When a proposal received has been determined to be satisfactory, a contract will be awarded within the time specified in the advertisement or the proposal. The Bidder selected as the apparent successful Bidder will be

notified by the Owner of its intention to award the contract. The notification will state that the apparent successful Bidder shall furnish to the engineer in **triplicate** properly executed Performance Bond and Payment Bond and Insurance Certificate within (7) days after the date of such notice.

The Bidder to whom the award is made shall execute the contract and return it together with the properly executed insurance certificates and copies of the polices to the office of the Engineer in time outlined herein. The insurance certificates shall stipulate also any conditions or exclusions affecting coverage specified in the policies.

If the contractor executes his contract as herein provided and the contract is not executed by the Owner within thirty (30) days after the receipt thereof from the contractor, the Owner upon written request of the contractor will return the proposal security and performance and payment bonds. In such event the award of the contract shall be considered annulled.

1.09 **Cancellation of award:** The Owner reserves the right to cancel the award of any contract at any time prior to the execution by the Owner.

1.10 **Surety bonds:** Prior to award of the contract, the successful Bidder shall furnish performance and payment bonds in the amount to not less than 100% of the contract amount, covering payment in full for all services rendered, including reasonable rentals of equipment; materials furnished and labor supplies or performed. The same surety must execute both bonds. All bonds shall be issued by companies authorized to transact business in Pennsylvania. All bonds shall be in the form as set forth in the contract documents.

Should any surety upon any bond furnished in connection with this contract become unacceptable or be deemed unsatisfactory to the Owner at any time, the contractor shall upon written notice from the Owner, promptly furnish acceptable or substitute security as may be required to protect the interests of the Owner or of persons supplying service (rentals included), labor, or materials in the prosecution of the work under contract. No further payment shall be deemed due or shall be made under the contract until the new surety or sureties shall qualify and be accepted by the Owner.

1.11 **Insurances:** The contractor shall not commence work under this contract until he has obtained all insurance required and furnished the Owner and engineer with certificates of insurance and such insurance and certificates have been approved.

(a) Compensation insurance -The contractor shall take out and maintain during the life of this contract workmen's compensation insurance for all of his employees employed at the site of the project, and in case any work is sublet, the contractor shall require the subcontractor similarly to provide workmen's compensation insurance for all the latter's employees. The contractor shall at all times, indemnify and save harmless the Owner and engineer of and form all claims for workmen's compensation which may be made by any employee of the contractor or his subcontractors.

(b) Liability insurance - The contractor shall take out and maintain during the life of this contract such public liability and automobile liability insurance as shall protect contractor performing

work covered by this contract from claims for damages for personal injury, including accidental death, as well as form claims for property damages, which may arise from operations under this contract whether such operations be by himself or by any subcontractor or by anyone directly or indirectly employed by either of them. Property damage liability insurance shall be written to include the hazards of explosion, collapse and underground. The amounts of the liability insurance shall be nondeductible and in amounts acceptable to the Owner.

(c) Builder's risk insurance -The contractor during the progress of the work and until final acceptance by the Owner upon completion of the entire contract, shall maintain insurance on all work included in the contract against loss or damage by fire, lightening, wind, explosion, and those perils covered by extended coverage endorsement and vandalism and malicious mischief on the completed value form, in the names of the Owner and the contractor as their respective interests may appear in an amount equal to 100% of the insurable value of each building or structure and materials included in this contract as shall fully protect the interests of the Owner and the contractor; the risk of damage to the construction work due to the perils covered by said insurance, as well as any other hazards which might result in damage to the construction work, that of the contractor and surety, and no claims for such loss or damage excuse the compete and satisfactory performance of the contract by the contractor.

(1) Accidents and claims -The contractor shall be responsible for all accidents and shall provide all of the indemnification.

(2) Mutual responsibility of contractors -Should a contractor in the performance of his contract cause damage to any person, any property, or work of another contractor working on this project, he shall upon due notice to do so from the Owner or other party to the damage, arrange for an amicable settlement thereon. It is agreed by all parties herein that such disputes shall not delay completion of the work, nor be cause for claim against the Owner. Work shall be continued by the party claiming damages at his expense, subject to such damages as may be obtained by due course of law.

(3) Contractor's liability: The status of the contractor in the work to be performed by him under this contract is that of an independent contractor and as such he hall properly safeguard against any and all injury or damage to the public, to public and private property, materials and things. The contractor shall keep the Owner and engineer free and discharged of any and all responsibility and liability for risks and casualties of every description as provided in the Agreement between the Owner and the contractor. The contractor shall assume and be liable for all blame and loss of whatsoever nature by reason of neglect or violation of any federal, state, county, or local laws, regulations or ordinances.

1.12 **Indemnity:** The contractor shall indemnify and hold harmless the Owner and the engineer and their agents and employees from all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claim, damage, loss, or expense (a) is attributable to bodily injury, sickness, disease or to destruction of tangible property (other than the work itself) including the loss of use resulting therefrom and (b) is caused in whole or in part by any negligent act or omission of the contractor, any

subcontractor, anyone directly or indirectly employed by and of them or anyone for whose acts of them may be liable, regardless of whether or not it is caused in part by a party indemnified thereunder. In any and all claims against the Owner or the engineer or any of their agents or employees by any employee of the contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this article shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the contractor or any subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

1.13 **Notice of accidents:** The contractor shall daily give written notice to Owner and engineer (in triplicate) of all accidents occurring in connection with the project. The contractor shall also make daily reports to the insurance companies of all said accidents, and to the Department of Labor and Industry.

1.14 **Payment of taxes:** The contractor will be responsible for the payment of all excise, sales, and use taxes, and all other taxes required by law on all materials, tools, apparatus equipment, fixtures, services, uses and incidentals which he purchases or uses for the purpose of fulfilling the work of this contract, and he shall include all amounts required for such taxes within the item prices bid in his proposal.

1.15 **Materials and Workmanship:** All materials, equipment, appliances and workmanship, unless otherwise specified, shall be the best of their respective kinds, and be in conformity and in harmony with the general intent and requirements to secure the best standard of work, the purpose of the design and all the work contemplated and described in them shall be done in a perfect and thoroughly workmanlike manner, and shall be required to produce the results specified in this contract, all to the satisfaction of the engineer. If at any time before commencement or during the process of the work, the materials and appliances used or to be used appear to the engineer as insufficient or improper for securing the quality of work required, he may order the contractor to improve their character and the contractor shall conform to such order, but the failure of the engineer to demand such improvement shall not release the contractor from his obligation to secure the quality of the work specified. The contractor hall use such plant and equipment as are required to properly execute the work within the time fixed in the contract. Where no requirements are specified for materials or for the methods of testing materials or equipment, they shall be determined by the latest standard or tentative specifications of the American Society for Testing Materials or the latest codes of the National Board of Fire Underwriters as they apply.

1.16 **Intent of Inspection:** The contractor shall not however, by such inspection be relieved of his obligation to supervise the work and fulfill in every way his contract, for it is hereby distinctly understood and mutually agreed to by both parties to this contract that an assistant or inspector on the work is not in any sense to be considered as a deputy-in-charge. The duties of an assistant or inspector are simply to act as a representative to protect the interests of the Owner, to report any deviations he may notice from the specifications and, if in his opinion, such action becomes necessary, to order the work stopped until the engineer is notified and has decided in what manner and by what methods the work shall proceed. Stop work orders will be issued in writing and will give the reason for their issuance. Such orders shall be received and immediately obeyed by the foreman in charge of the work.

1.17 **Delegation of Inspection:** The engineer or Owner shall have the right to delegate such inspection to such person or persons as they may see fit to employ for the said purpose. Such inspectors or assistants will call to the attention of the contractor or his representative any departure from or infraction of the provisions of this contract in the progress of the work, but no person or persons other than by the consent of all parties to the agreement shall have power or authority to waive or modify any provisions of this contract. No instructions or permissions shall be given to the contractor by said inspectors or assistants or by persons other than by expressed authority of the engineer in writing. The failure on the part of the said inspector or assistants, or any other persons to notify the said contractor of faults or omissions in the carrying out of said work shall not justify or excuse the said contractor for any failure on his part to fully perform all of the conditions, provisions and agreements that are to be kept, observed, or performed by him in accordance with the terms of this contract.

1.18 **Provisional Acceptance:** All material, equipment, appurtenances or work once accepted by the Engineer may be rejected at any time should any defect in the same or any variations form the requirements of the specifications be discovered before the entire work has been finally accepted. No certificate given or, payments made shall be construed as acceptance of defective work or improper material.

1.19 **Progress of Work:** If at any time, the rate of progress is such that in the judgment of the engineer, the work will not be completed within the time specified, he may so notify the contractor who thereupon will proceed at once with such additional force, machinery, equipment, and methods as are required to finish the work on time, but the failure of the engineer to give such notice shall not relieve the contractor of his obligation to complete the work at the time specified in this contract.

1.20 **Work Schedule:** No work can occur between the hours of 8:00AM to 4:00PM Monday through Friday.

1.21 **Work in Bad Weather:** During freezing, stormy or inclement weather, no work shall be done except such as can be done satisfactorily and in a manner to produce acceptable results.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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Professional Engineers in Private Practice

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These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*—The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work*—See Paragraph 11.01 for definition.

17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *Engineer*—The individual or entity named as such in the Agreement.

20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

21. *General Requirements*—Sections of Division 1 of the Specifications.

22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*—Polychlorinated biphenyls.

31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.

47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

49. *Unit Price Work*—Work to be paid for on the basis of unit prices.

50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen

subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on

Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the

scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly

licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

a. Such insurance shall remain in effect for two years after final payment.

b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors

of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent

bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

1. perform adequately the functions and achieve the results called for by the general design,

2. be similar in substance to that specified, and

3. be suited to the same use as that specified;

2) will state:

1. the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

2. whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

3. whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

1. all variations of the proposed substitute item from that specified, and

2. available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be

required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

   1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

   2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against

Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable,

brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss;

and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

a. Submit number of copies specified in the General Requirements.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly

employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents.

Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of

explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;

2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than

those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by

Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and

testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or

otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is

found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim

therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

    a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

    b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work, or

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

    d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

    d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

c. there are other items entitling Owner to a set-off against the amount recommended; or

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider

the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

   b. consent of the surety, if any, to final payment;

   c. a list of all Claims against Owner that Contractor believes are unsettled; and

   d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release

or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work,

such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or

2. agrees with the other party to submit the Claim to another dispute resolution process; or

3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SECTION 3
LOCATION, SCOPE, SPECIAL CONDITIONS, AND DESCRIPTION OF BIDS

LOCATION

The work covered by these specifications is located at the Fayette County Courthouse Conference Room Expansion, 61 East Main Street, City of Uniontown, Fayette County, Pennsylvania. The project involves office renovations.

SCOPE

To furnish the necessary labor, supervision, power equipment, and material to complete the renovations at the Fayette County Commissioners Conference Room Expansion as identified on the drawings and the technical specifications provided by McMillen Engineering, Inc. and inferred herein. The drawings are a part of these contract documents and are referred to as "Fayette County Commissioners Conference Room Renovations", dated August 2020. The construction includes but is not limited to the following items:

- Renovation of existing conference room

SPECIAL CONDITIONS

The following are special conditions of the Fayette County Courthouse Conference Room Expansion:

1. Contractors Coordination
   It is the responsibility of the contractor to coordinate his work with other contractors at the site, with the Owner, the resident inspector, the project engineers, the general project manager, regulatory agencies, utilities, and to afford other contractor's full access to the work site.

2. Construction Laws
   The contractor and all subcontractors shall comply with all Federal, State, and Local laws pertaining to Construction Safety and Health. The contractor and all subcontractors shall meet the requirements of the Federal Register XVII, Part 1926 of Title 29, the Federal Construction Safety Act, the OSHA Regulations, and all publications that update these publications. The Owner is not responsible or liable for payment of any citations received by the contractor or subcontractor for failure to comply with the OSHA standards.

3. Safety
   The contractor is responsible to protect the site, his work, and all person near the site.

4. Maintaining Traffic:
   In general, a minimum of one lane of traffic shall be maintained on all streets, roads, and construction entrances at all times during construction.

5. Limit of Construction
   The contractor is responsible for all work shown on the drawings.

6. Construction Surveying:
   It is the contractor's responsibility to provide all construction surveying.

7. Or Equals
   For any and all items the contractor plans to use as an or equal product, the contractor must submit to the engineer detailed shop drawings and technical specifications by 4:00pm, 5 working days prior to the bid opening for engineer's approval.

8. Excess Waste Material
   Excess waste material from the project area shall be disposed of by the Contractor.

9. Qualifications of Bidders
   No proposal will be considered from any Bidder unless he is known to be skilled in work of a similar nature to that covered by this contract and has sufficient capital to meet all obligations to be incurred in carrying out the work.

10. Request for Information or Questions
    Any and all Request for Information regarding the project shall be submitted to the engineer in writing. Only questions in writing will be answered by the engineer. Copies of the questions and answers will be forwarded to all Bidders. All requests for information must be received by 4:00pm, 5 working days prior to the bid opening. The address for submission of questions is: McMillen Engineering, Inc., 115 Wayland Smith Drive, Uniontown, PA 15401 or to Ron Herrington, P.E. at rherrington@mcmilleng.com.

11. Submittals
    The contractor shall submit two paper copies (or digital copy) of all certificates, permits, shop drawings, manufacturer's literature, and other requested documentation to the Engineer for review and approval prior to commencing work. The submittals shall be provided in accordance with the following sections of these contract documents.

12. Change Orders
    The contractor shall receive written approval of all change orders prior to performing any additional services. The Owner will not pay for any services provided without written approval. The Owner will respond to all requests for additional services within 3 days of notification from the contractor.

13. Permits
    Contractor responsible to secure all required permits (local, state and/or federal) as required for the scope of work.

14. Weekly Meetings
    The selected Contractor will meet weekly with the Owner and/or Engineer during normal business hours.

15. Schedules
    It is the responsibility of the general contractor to coordinate all prime contractors' schedules for the project.

16. Construction Schedule
    The construction schedule, as reviewed by all Prime Contractors, Construction Manager, Engineer, and Owner, will be an integral part of the contract, and will establish interim work completion dates for the various activities. Within five (5) days of receipt of Notice to Award of Contract, each Prime Contractor shall submit a preliminary construction schedule to the Engineer and Director of Buildings and Grounds. Also, each Prime Contractor shall provide to the Engineer a separate schedule of submittal dates. The Construction Schedule shall be the basis for the dates to state and complete work for the various portions of the Contract.

    Each Prime Contractor shall submit two copies of a weekly updated Construction Schedule comparing the original schedule to work in progress and projected work along with the application for payment. Should any work not be started or completed within ten dates of the current scheduled date, the Director of Buildings and Grounds and the Engineer shall have the right to perform the work, have the worked performed by whatever method the Director of Buildings and Grounds and the Engineer deems appropriate, or terminate the Prime Contractor's contract, without additional compensation to the Prime Contractor. The Contractor shall be assessed $2,000.00 per day back charge for every day, which extends beyond the contract completion date of December 15, 2020 for liquidated damages.

17. Prime Contractor Coordination
    It is the responsibility of the Electrical, and or Plumbing contractor to coordinate his work with the prime general contractor, other contractors at the site, the owner, the engineer, the general project manager, regulatory agencies, utilities, and to afford other contractors full access to the work site.

18. Work Hours
    No work can occur between the hours of 8:00AM to 4:00PM Monday through Friday.

19. Record Set
    The successful Bidder will provide at the completion a record set of all construction improvements.

20. Background Check
    The selected contractor and all employees may be subject to a background check. The County reserves the right to refuse any and all employees at their discretion.

21. Plans and Materials
    Dimensions shown on Plans are approximate and Contractor is responsible for their own quantity take-off.

22. Fixtures, Furniture, Wall Coverings, Etc.
    The selected Contractor is to salvage all marble, wall coverings, doors and hardware, plumbing fixtures, etc. Coordinate with the County Director of Buildings and Grounds.

23. Plan Details

The furniture, appliances, and equipment are not included in said Bid as noted on the Plans. The TV monitors will be provided by the County and are to be installed by the contractor.

24. Insurance Requirements

Prior to execution of the contract, Contractor and its subcontractors shall provide the Owner with evidence of insurance in form and substance acceptable to the Owner. Execution of a contract is conditional on receipt of such evidence; failure to obtain or maintain required coverage during the entire term of the contract is reason for the Owner to terminate the contract.

- Workers' Compensation Insurance
- Automobile Liability Insurance
- General Liability

For all coverages:

1. The policy form must be on an "Occurrence" basis
2. The insurance company must have an A.M. Best's Rating of A- or higher and VI or higher
3. The insurance company must provide (not just endeavor to provide) the Owner's project manager (Public Works Director) with at least thirty (30) days' notice of cancellation or material change.
4. The policy terms (conditions, exclusions, limitations, etc.) must be acceptable to the Owner
5. There must be no cross-insured liability exclusions.
6. The certificate of insurance must not include a "Matter of Information on" limitation
7. The Owner and its employees and officials should be included as Additional Insured as respects to this contract
8. The Owner, its agents, and its employees shall be listed as an Additional Insured under the terms of the policy

The Certificate of Insurance shall be submitted to the Owner by the successful bidder within ten (10) calendar days from the date the Notice of Intent to Award is received. Upon request from the Owner, the Contractor shall provide documentation, including a copy of the policy, that the appropriate and applicable insurance has been procured.

DESCRIPTION OF BIDS

The work covered by these specifications is located at the Fayette County Courthouse Conference Room Expansion, 61 East Main Street, City of Uniontown, Fayette County, Pennsylvania.

Base Bid General Contractor:
The contractor shall provide the total cost for the base bid in his proposal.

Base Bid Electrical:
The contractor shall provide the total cost for the base bid in his proposal.

Base Bid Plumbing:
The contractor shall provide the total cost for the base bid in his proposal.

SECTION 03 54 16 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Polymer-modified, self-leveling, hydraulic cement underlayment.

a. Scope: Entire project area.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 HYDRAULIC CEMENT UNDERLAYMENTS

A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.

1. Manufacturer/Product: Provide K15 manufactured by Ardex Americas or equal by BASF, Dayton Superior or Euclid Chemical.
2. Cement Binder: ASTM C150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.
3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C109.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

F. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, or as recommended by hydraulic cement underlayment manufacturer.

C. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.

1. Install underlayment reinforcement recommended in writing by manufacturer.

D. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

E. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Apply surface sealer at rate recommended by manufacturer.

G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035416

SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wood blocking, cants, and nailers.
2. Wood furring and grounds.
3. Plywood backing panels.
    a. Provide backing panels coordinating size, locations, and equipment mounting requirements with the telecommunications and electrical equipment.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments specified to be High-Temperature (HT) type include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements of FRTW that has a flame spread of 25 or less and complies with ASTM E84.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Exterior type for exterior locations and where indicated.
3. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

D. Application: Treat all miscellaneous carpentry, unless otherwise indicated to be preservative treated.

2.4 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness.

B. Dimension Lumber Framing: No. 2 grade and any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.
4. Furring.
5. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB, or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. For exposed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
2. Mixed southern pine, No. 1 grade; SPIB.
3. Hem-fir or hem-fir (north), Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.
4. Spruce-pine-fir (south) or spruce-pine-fir, Select Merchantable or No. 1 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods, No. 2 Common grade; NELMA.
5. Northern species, No. 2 Common grade; NLGA.
6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

B. Provide backing panels coordinating size, locations, and equipment mounting requirements with the telecommunications and electrical equipment.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, fire retardant treated, dissimilar materials, or in area of high relative humidity, provide fasteners as recommended by pressure-preservative or fire retardant treatment manufacturer.

a. Where fasteners are in contact with dissimilar materials or metals, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material for Fasteners installed in conditioned (heated and air-conditioned) interior paces: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Fasteners installed in exterior and unconditioned (heated only, or ventilated only) interior spaces: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

C. Do not splice structural members between supports, unless otherwise indicated.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

I. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 06 41 00 - INTERIOR ARCHITECTURAL CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Plastic-laminate casework.
2. Solid wood base.
3. Casework Hardware

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

2. Division 12 Section “Solid Surface Countertops”.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including panel products, lumber, high-pressure decorative laminate, adhesive for bonding plastic laminate, fire-retardant-treated materials, stain finish system and cabinet hardware and accessories.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
2. Core Material, 12-inch-square Sample showing corner.
3. Exposed cabinet hardware and accessories, one for each type and finish.
4. Lumber for Transparent Finish: Not less than 12 inches long, finished on one side and one edge.
5. Veneer-Faced Panel Products for Transparent Finish: 12 by 12 inches, include one face-veneer seam.

D. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop shall be familiar with AWI standards and shall have the current copy of the standards available in the shop if asked for by the Architect.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

C. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

D. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork and wall panels by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork and wall panels without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Substrate panel product for casework up to 7/8" thick:. Particleboard, average 47 pound density, ANSI A208.1; Grade M-2-Exterior Glue.
2. Substrate panel product for casework 1' thick and thicker: Particle board, average 45 pound density, ANSI A208.1, Grade M-2- Exterior glue.
3. Medium density fiberboard for wood laminate wall panels 3/4" thick, ANSI A208.2

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.

b. Lamin-Art, Inc.
c. Pionite; a Panolam Industries International, Inc. brand.
d. Wilsonart LLC.

2. Colors and Patterns: As selected by the Design Professional from the manufacturers full range.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets. Refer to cut sheets at the end of this Section for basis of design hardware.

B. Exposed Hardware Finishes: Unless otherwise stated, for exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.

C. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

D. Products: Provide the following cabinet hardware items:

1. Drawer Pulls: four-inch wire pulls; finish selected by Design Professional.
2. Doors: four-inch wire pulls; finish selected by Design Professional.

E. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening, self-closing.

1. Swing: 270 degrees without binding.
2. Doors less than 36" in height: Two hinges.
3. Doors 36" or over in height: Three hinges.

F. Provide two rubber bumpers per door.

G. 7 pound magnetic catch per door. Provide two for doors 48 high and over.

H. Drawer Slides:

1. Standard Drawer: Self-closing, bottom-mount epoxy coated with captive roller and positive in stop. Slide shall have 150# rating, must be self-closing within last 3" of travel, and must prevent drawer fronts from contacting the cabinet body.
2. File Drawers: Full extension, bottom-mount epoxy coated with captive roller and positive instop. Slide shall have 100# rating, must be full extension, and prevent drawer fronts from contacting the cabinet body.
3. File drawers shall be equipped with "Pendaflex" file frames or equal manufactured units.
4. Drawer Stops: Designed to permit easy removal, and yet prevent inadvertent drawer removal. Provide on all drawers, located on the inside.

I. Shelving Hardware:

1. Open Shelving: Knape & Vogt 80 standards and 180 brackets, or equal regular duty single slot system.. Anochrome finish.
2. Adjustable Brackets: K&V #179 Seeries Adjustable Slat Bracket ,14 gage, Anochrome finish, length as noted on the drawings. Provide two #154 ANO Shelf fasteners per shelf.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.5 PLASTIC-LAMINATE CABINETS (Flush Overlay Design)

A. Provide in accordance with AWI Architectural Woodwork Standards; Premium Grade.

B. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

C. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.
4. Edges: Grade HGS.
5. Pattern Direction: Wood grain-vertically for drawer fronts, doors, and fixed panels.

D. Semi-Exposed Surfaces: Behind doors, drawer boxes, and unfinished panels.

1. Thermoset decorative panels.

2. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.

E. Backing (concealed surfaces): high pressure backer Type BKH (0.28)

F. Edges: Grade HGS

G. Concealed Surfaces: Sound and dry solid wood, plywood, or particleboard without defects affecting strength, utility, or stability.

H. Back Panels: 1/2" particleboard surfaced both sides for balanced construction.

I. Joinery:

1. Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.
2. Cabinet body components may be secured utilizing concealed interlocking mechanical fasteners as approved by the Architectural Woodwork Quality Standards 6th Edition – 1994 Sections 1600A-S-10 and AWI 1600B-S-9.
3. All joints are tight fitting and will not rupture or loosen due to the following:

   a. Dimensional changes in the particleboard.
   b. Racking of casework during shipment and installation.
   c. Normal use.

4. All fastening devices and screws shall be treated to deter or resist corrosion.

J. Adjustable Shelving at Casework:

1. Color to match color of cabinet interior.
2. Adjustable shelves in open units and shelves over 36" long shall be 1" thick.
3. All other shelves shall be 3/4" thick.

K. Sub-base: Individual factory applied 3/4-inch-thick particleboard.

L. Toe Board: 5/8-inch-thick exterior grade plywood attached to sub-base with concealed fasteners.

M. Adjustable Shelf Supports within casework:

1. Shelf supports shall be injected molded clear plastic, with a double pin engagement 32 mm on center and shall have ¾" and 1" anti-tip locking tabs. Provide 200 extra shelf supports.
2. A 5 mm diameter row hole pattern 32 mm (1/4") on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components
   a. Edges, Corners: Rounded

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.

Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips or toggle bolts through metal backing or metal framing behind wall finish.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

H. Installation Tolerances: As follows:

1. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm).
2. Variation of Panel Joints from Hairline: Not more than 1/16 inch (1.6 mm) wide.

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler, and sand smooth where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

D. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer’s written instructions.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that fabric wrapped wall panels are without damage or deterioration at time of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 064100

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

    a. All joints between dissimilar materials.

2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    e. Other joints as indicated.

3. Interior joints in the following horizontal traffic surfaces:

    a. Isolation joints in cast-in-place concrete slabs.
    b. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated, including VOC content data.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

F. Qualification Data: For Installer.

G. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

I. Field Test Report Log: For each elastomeric sealant application.

J. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

K. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Design Professional.
2. Conduct field tests for each application indicated below:

    a. Each type of elastomeric sealant and joint substrate indicated.
    b. Each type of nonelastomeric sealant and joint substrate indicated.

3. Notify Design Professional seven days in advance of dates and times when test joints will be erected.
4. When testing sealant at EIFS, arrange for tests to take place with joint-sealant manufacturer and EIFS manufacturer technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: As selected by Design Professional from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

1. Available Products:

a. Dow Corning Corporation; 786 Mildew Resistant.

b. Momentive Performance Materials, Inc. (formerly GE Advanced Materials) - Silicones; Sanitary SCS1700.
c. Tremco; Tremsil 200 Sanitary.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: Coated glass color anodic aluminum coated with a high-performance coating ceramic tile.

E. Multicomponent Nonsag Urethane Sealant:

1. Available Products:

a. Pecora Corporation; Dynatrol II.
b. Polymeric Systems, Inc.; PSI-270.
c. Tremco; Dymeric 240.

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50.
4. Use[s] Related to Exposure: NT (nontraffic) and T (traffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: Color anodic aluminum coated with a high-performance coating galvanized steel, brick, ceramic tile and wood.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type OP, Grade NF.

B. Available Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Available Products:

    a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
    b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Available Products:

    a. Pecora Corporation; BA-98.
    b. Tremco; Tremco Acoustical Sealant.

2.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
    b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, Method B, Exposed Surface Finish Hand Pull Tab, Method C, Field-Applied Sealant Joint Hand Pull Flap, or Method D, Water Immersion in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
4. Inspect tested joints and report on the following:

    a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
    b. Whether sealants filled joint cavities and are free of voids.
    c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant acid-curing silicone sealant.
2. Joint-Sealant Color: As selected by Design Professional from manufacturer's full range.

B. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.

1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: As selected by Design Professional from manufacturer's full range.

C. Interior control, expansion, and isolation joints in horizontal traffic surfaces.

1. Joint Sealant: Multicomponent nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Design Professional from manufacturer's full range.

END OF SECTION 079200

SECTION 08 11 13 – HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hollow-metal steel frames.

B. Related Sections include the following:

1. Division 08 Section " Glazing" for glazed lites in frames.
2. Division 09 painting Sections for field painting hollow metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance and temperature-rise ratings, and finishes for each type of steel door and frame specified.

B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:

1. Frame details for each frame type, including dimensioned profiles.
2. Details and locations of reinforcement and preparations for hardware.
3. Details of each different wall opening condition.
4. Details of anchorages, accessories, joints, and connections.
5. Details of glazing frames and stops showing glazing.
6. Details of conduit and preparations for electrified door hardware and controls.

C. Coordination Drawings: Drawings of each opening, including door and frame, drawn to scale and coordinating door hardware. Show elevations of each door design type, showing dimensions, locations of door hardware, and preparations for power, signal, and electrified control systems.

D. Oversize Construction Certification: For standard steel door assemblies required to be fire rated and exceeding limitations of labeled assemblies; include statement that doors comply with requirements of design, materials, and construction but have not been subjected to fire test.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel frame.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain standard steel frames through one source from a single manufacturer.

D. Fire-Rated Door Sidelight and Transom Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test according to UBC Standard 7-2. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.
3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

E. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to UBC Standard 7-4. Label each individual glazed lite.

F. Smoke-Control Door Assemblies: Comply with UBC Standard 7-2.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked unit to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steelcraft; an Allegion Brand.
2. Ceco Door Products; an ASSA ABLOY Group Company.
3. Republic; an Allegion Brand.
4. Pioneer Industries.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy (galvannealed) coating designation.

D. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153, Class B.

E. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153.

F. Grout: Comply with ASTM C 476, with a slump of 4 inches for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143.

G. Glazing: Comply with requirements in Division 8 Section "Glazing."

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames and interior frames noted to be galvanized: Fabricated from metallic-coated steel sheet.

1. Fabricate exterior frames as full profile welded.
2. Frames for Level 3 Steel Doors: 0.053-inch-thick steel sheet.

C. Interior Frames: SDI A250.8..

1. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
2. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
3. Construction: Full profile welded.
4. Exposed Finish: Primed.

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.

2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.

E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

F. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

G. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

I. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- wide steel.

J. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.4 STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.

B. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.5 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
4. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches in height.
        2) Four anchors per jamb from 60 to 90 inches in height.
        3) Five anchors per jamb from 90 to 96 inches in height.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
        5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

    b. Compression Type: Not less than two anchors in each jamb.
    c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

D. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of frame.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior frames.
4. Provide loose stops and moldings on inside of doors and frames.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.6 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish standard steel door and frames after assembly.

B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Standard Steel Frames: Install standard steel frames for doors, sidelights, transoms, borrowed lights and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Install frames with removable glazing stops located on secure side of opening.
    c. Install door silencers in frames before grouting.
    d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    e. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    f. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
3. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
4. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Five-ply flush wood veneer-faced doors for transparent finish.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections include the following:
   1. Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate requirements for veneer matching.
   2. Indicate doors to be factory finished and finish requirements.
   3. Indicate fire ratings for fire doors.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
   1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.

D. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors."

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
   1. Test Pressure: Test at atmospheric pressure.
   2. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450° F (250° C) maximum in 30 minutes of fire exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90° F (16 and 32° C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
      a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Flush Wood Doors:
      a. Algoma Hardwoods Inc.; a Masonite company
      b. Eggers Industries; Architectural Door Division.
      c. Graham Wood Doors.; an Assa Abloy Group company
      d. Marshfield Doors; a Masonite company.
      e. Mohawk Flush Doors, Inc.; a Masonite company
      f. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Adhesives: Do not use adhesives containing urea formaldehyde.

B. Doors for Transparent or Opaque Finish:
   1. Grade: Premium, with Grade A faces.
   2. Species and Cut: White Maple, plain sliced.
   3. Match between Veneer Leaves: Book match.
   4. Assembly of Veneer Leaves on Door Faces: Balance match.
   5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
   7. Stiles: Same species as faces.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

   1. Particleboard: ANSI A208.1, Grade LD-2.
      a. Use particleboard made with binder containing no urea-formaldehyde resin.
   2. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

B. Interior Veneer-Faced Doors:

   1. Core: Particleboard or Either glued block or structural composite lumber.
   2. Construction: Five plies with stiles and rails bonded to core, and then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:
   1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
   2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
   3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.
   4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:
   1. Wood Species: Same species as door faces.
   2. Profile: Flush rectangular beads.
   3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
   1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
   1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
   1. Light Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099123 " Painting."

2.7 FACTORY FINISHING

A. General: Comply with AWI's "Architectural Woodwork Standards" for factory finishing.

B. Finish doors at factory.

C. Transparent Finish:
1. Grade: Premium.
2. Finish: AWI System TR-6 catalyzed polyurethane; including top and bottom of doors.
3. Staining:.
4. Effect: Filled finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

B. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

C. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

D. Hang all doors so they remain fully and totally closed without latching.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior ceilings and soffits.
3. Flat strap and backing plate.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For firestop tracks from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653, G60 hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

   a. Minimum Base-Metal Thickness: 0.0296 inch (20-gauge).
   b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:

1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
      2) Steel Network Inc. (The); VertiClip SLD Series.
      3) Superior Metal Trim; Superior Flex Track System (SFT).

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fire Trak Corp.; Fire Trak System.
   b. Grace Construction Products; FlameSafe FlowTrak System.
   c. Metal-Lite, Inc.; The System.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.033 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch.
2. Depth: 7/8 inch (22.2 mm).

H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 3/4 inch (19 mm).
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch-wide flanges.

1. Depth: 2-1/2 inches.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.

a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).

4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical or hat shaped.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Grid System.
c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.

b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

E. Z-Furring Members:

1. Erect insulation, specified in Division 07 Section "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.

2. Tile backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

C. Data indicating compliance with specified STC rating.

1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 1396; as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. G-P Gypsum.
    b. National Gypsum Company.
    c. USG Corporation.

B. Provide Type X, ASTM C1396, unless otherwise indicated:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Georgia-Pacific Gypsum LLC.
    c. United States Gypsum Company (USG); Durock Glass-Mat Tile Backerboard.

2. Core: As indicated on Drawings.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    e. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
b. Grabber Construction Products; Acoustical Sealant GSC.
c. Pecora Corporation; AC-20 FTR.
d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
e. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Latex Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834 and the following requirements:

a. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E90.
b. Product has flame-spread and smoke-developed ratings of less than 25 per ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Installation of paper faced panels shall not begin until areas receiving panels is conditioned space.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

C. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

D. Form control and expansion joints with space between edges of adjoining gypsum panels.

E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: As indicated on Drawings.
2. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:
1. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile and where shown on Drawings. Install with 1/4-inch gap where panels abut other construction or penetrations.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Design Professional for visual effect.

C. Interior Trim: Install in the following locations:

1. Reveal: Use where indicated.
2. Cornerbead: Use at outside corners.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section

1.2 SUMMARY

A. Section Includes:

1. Porcelain floor tile.
2. Glazed wall tile.
3. Waterproof membrane for thinset applications.
4. Metal edge strips.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Metal transition strips.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Ceramic Tile Type: Unglazed porcelain floor tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Olean; a division of Dal-Tile Corporation.
    b. Crossville, Inc.
    c. Daltile.
    d. Seneca Tiles, Inc.
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 11-13/16 by 11-13/16 inches.
4. Face Size Variation: Rectified.
5. Thickness: 3/8 inch.
6. Dynamic Coefficient of Friction: Not less than 0.42.
7. Tile Color, Glaze, and Pattern: As selected by Design Professional from manufacturer's full range.
8. Grout Color: As selected by Design Professional from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base: Coved, module size 4-1/4 by 4-1/4 inches.

B. Ceramic Tile Type: Glazed wall tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Olean; a division of Dal-Tile Corporation.
b. Daltile.
c. Seneca Tiles, Inc.

2. Module Size: 4-1/4 by 4-1/4 inches.
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch (8 mm).
5. Tile Color and Pattern: As selected by Design Professional from manufacturer's full range.
6. Grout Color: As selected by Design Professional from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
   a. Wainscot Cap: Bullnose cap, module size 4-1/4 by 4-1/4 inches.
   b. External Corners: Bullnose, same size as adjoining flat tile.
   c. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.3 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Bostik, Inc.
   b. Custom Building Products.
   c. Laticrete International, Inc.
   d. MAPEI Corporation.
   e. Sakrete; CRH Americas, Oldcastle APG.

2.4 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ARDEX Americas.
   b. Bostik, Inc.; Bostik PM
   c. Custom Building Products.
   d. Laticrete International, Inc.

e. MAPEI Corporation.
f. Sakrete; CRH Americas, Oldcastle APG.

2. For wall applications, provide nonsagging mortar.

2.5 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ARDEX Americas.
b. Bostik, Inc.; Hydroment Vivid
c. Custom Building Products.
d. Laticrete International, Inc.
e. MAPEI Corporation.
f. Sakrete; CRH Americas, Oldcastle APG.

2. Unsanded at glazed wall tile.

3. Polymer Type: Dry, redispersible form, prepackaged with other dry ingredients.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic, designed specifically for flooring applications; nickel silver exposed-edge material.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Schluter Systems L.P.

b. Provide at transitions between tile and adjacent flooring.

C. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout. Provide only where recommended by grout manufacturer for this specific application. Coordinate with Owner’s facilities manager prior to beginning sealing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

   a. Tile floors in wet areas.
   b. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Glazed Wall Tile: 1/8 inch (3.2 mm).
   2. Porcelain Tile: 1/4 inch (6.4 mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where directed by Design Professional. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

K. Floor Sealer: Apply floor sealer to grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

L. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

M. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

   1. Ceramic Tile Installation: TCNA F122; thinset mortar on waterproof membrane.

a. Ceramic Tile Type: Porcelain.
b. Thinset Mortar: Modified dry-set mortar.
c. Grout: High-performance sanded grout.

B. Interior Wall Installations, Masonry or Concrete:

1. Ceramic Tile Installation: TCNA W202; thinset mortar.

a. Ceramic Tile Type: Glazed.
b. Thinset Mortar: Modified dry-set mortar.
c. Grout: High-performance unsanded grout.

END OF SECTION 093013

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical panels, and exposed suspension systems for ceilings.

1.3 DEFINITIONS

A. CAC: Ceiling Attenuation Class.

B. LR: Light Reflectance coefficient.

C. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.

C. Quality Assurance Submittals:

1. Coordinate Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

    a. Ceiling suspension members.
    b. Method of attaching hangers to building structure.
    c. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
    d. Minimum Drawing Scale: 1/4 inch = 1 foot.

2. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

D. Closeout Submittals:

1. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications:

B. An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

C. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Quantity of each ceiling panel equal to 3 percent of quantity installed; not less than one full box.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

2.2 ACOUSTICAL PANELS

A. Basis-of-Design: Ultima High NRC No. 1942

1. ASTM E1264 Classification:
2. Edges: Beveled tegular
3. Size: 24 by 24 x 7/8 inches.
4. NRC: 0.80
5. Fire Class: Class A.
6. Fire Performance UL 723 (ASTM E 84) Flame Spread / Smoke Developed: 0/5.
7. Light Reflectance: 0.88

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Performance Standard: Suspension system manufacturer’s standard direct-hung metal suspension system and attachment devices complying with project requirements and applicable building codes and regulations applicable at the location of the project and as follows:
1. Structural Classification: Intermediate duty system, ASTM A 635.
2. Face Design: Flat, flush.
3. Cap Material: Steel cold-rolled sheet.
4. Cap Finish: Factory painted white color.

B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.

2.4 METAL EDGE MOLDINGS, TRIM AND ACCESSORIES

A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning

and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 09 64 00 – LAMINATE WOOD FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Laminate wood flooring.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected

C. Samples: For each exposed product and for each color and texture specified.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Laminate Wood Flooring: Equal to 3 percent of amount installed for each type.

1.4 FIELD CONDITIONS

A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.

1. Environmental Conditioning: Maintain ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.

    a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
    b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

1.5 WARRANTY

A. Manufacturer Warranty: Provide a written warranty, signed by laminate wood manufacturer agreeing to repair or replace laminate wood flooring that fails in materials or workmanship. Failures include, but are not limited to, buckling, warping, delamination, fade and surface-wear-through:
   1. Duration: 10 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LAMINATE WOOD FLOORING

A. General: Laminate waterproof flooring with integral underlayment; tongue and groove edges for click-in installation.

   1. Basis of Design: Pergo Outlast + SpillProtect.
   2. Pattern and Color: As selected by the Design Professional from the manufacturer's full range.
   3. Thickness: 10mm.
   4. Finish: UV stable and waterproof.

2.2 ACCESSORY MATERIALS

A. Vapor Retarder: ASTM D4397, polyethylene sheet not less than 6.0 mils thick or as otherwise recommended by laminate wood flooring manufacturer.

B. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.

C. Reducer Strips: To match wood flooring. 2 inches (51 mm) wide, tapered, and in thickness required to match height of flooring.

D. T-Strips: Furnished in lengths as long as practical and in thickness to match wood flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 4.5 lb of water/1000 sq. ft. (2.04 kg of water/92.9 sq. m) in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement or level specifically recommended by manufacturer.
    c. Perform additional moisture tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Concrete Slabs:

1. Grind high spots and fill low spots to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
3. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

B. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with flooring manufacturer's written installation instructions.

B. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch (19 mm).

C. Vapor Retarder; if required as a result of humidity and moisture testing: Comply with the following for vapor retarder installation:

1. Wood Flooring Installed Directly on Concrete: Install manufacturer recommended layer of vapor retarder according to flooring manufacturer's written instructions.

D. Laminate Wood Flooring: Install floating floor.

3.4 PROTECTION

A. Protect installed flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.

1. Do not move heavy and sharp objects directly over kraft-paper-covered laminate wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096400

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes the following:

1. Resilient wall base.

2. Resilient flooring accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Verification: In manufacturer's standard sizes, one of each product color and pattern specified.

C. Product Certificates: Signed by manufacturers of resilient wall base and accessories certifying that each product furnished complies with requirements.

1.4 QUALITY ASSURANCE

A. Installer qualifications: Engage and experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 W/sq. Cm or greater when tested per ASTM E 648.

2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F (13 deg C) or more tan 95 deg F (35 deg C).

B. Do not install products until they are at the same temperature as the space where they are to be installed.

C. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.

D. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

B. Product: Refer to the Finish Legend for the Basis of Design products. Subject to compliance with requirements, equal products by other manufacturers may be submitted for review. Aesthetic equality will be judged solely by the Owner and Design Professional. Submit manufacturers product data and color samples.

2.2 RESILIENT WALL BASE

A. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

B. Resilient Wall Base (B1):

1. 4 inches straight and coved base.

2. Provide in coils greater than 100' in length.

3. Provide pre-molded outside corners.

4. Color as indicated on Finish Legend.

2.3 RESILIENT ACCESSORIES

A. Rubber Accessories: Products complying with requirements:

1. Description: Rubber reducer strip for resilient floor covering and carpet and transition strips.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer and manufacturer's representative present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Install resilient products according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

3. Do not stretch base during installation.

4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler materials.

5. Install premolded outside corners before installing straight pieces.

    a) Outside corners have minimum 3" leg.

6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

D. Provide resilient transition strips at all transitions from different types of resilient flooring, resilient flooring to carpet, and resilient flooring to existing flooring.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.

2. Sweep or vacuum horizontal surfaces thoroughly.

3. Do not wash resilient products until after time period recommended by resilient product manufacturer.

4. Damp-mop or sponge resilient products to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.

C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

END OF SECTION 096513

SECTION 09 91 23 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes painting, using types as specified herein, and colors as indicated or later selected by Design Professional. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1. Work includes painting and finishing of typical interior and exterior exposed surfaces and items throughout Project, except as otherwise indicated.

2. Work includes field-painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment unless otherwise indicated.

   Painting of exposed bare and covered pipes, conduit, ducts and hangers etc., shall be by the painting Contractor. Disregard reference to painting of exposed bare and covered pipes, conduit, ducts and hangers etc. by the electrical, plumbing, mechanical, security and data Contractors. The Division 9 Painting specification supersedes the requirements for painting specified in the mechanical, electrical, plumbing, fire protection, security and data specifications.

   Exposed bare and covered pipes, conduit, ducts and hangers etc. shall be painted to match the adjacent wall color except where located in stair towers and mechanical rooms. In stair towers and mechanical rooms, exposed bare and covered pipes, conduit, ducts and hangers etc. shall be color coded as required by the governing building code and as approved and directed by the Owner. Requirements in Divisions 21, 22, 23, 26, 27 and 28 for equipment, pipe, duct, valve, etc. labeling shall remain as specified.

3. Surface preparation, priming, and coats of paint specified are in addition to shop-priming and surface treatment specified under other Sections.

1.3 RELATED WORK AND WORK NOT INCLUDED

A. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various Sections for structural steel, metal fabrications, hollow metal work, and similar items.

B. Pre-Finished Items: Unless otherwise specified, this Section does not include painting of pre-finished items, such as exterior and wall panels, metal doors and frames, metal windows and curtainwall, plastic-laminate casework, and finished mechanical equipment and electrical fixtures.

C. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces with baked-on coatings, anodized aluminum, stainless-steel, chromium plate, copper, bronze, and similar finished materials will not require finish painting.

D. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed and inaccessible areas, furred areas, pipe spaces, and duct shafts.

E. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.

F. Labels: Contractor shall not paint over any code-required labels, such as UL (Underwriters Laboratories) and FM (Factory Mutual), or any equipment identification, performance rating, name, or nomenclature plates.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data and technical information for each paint system specified, including paint label analysis and application instructions for each material proposed for use.

1. List each material and cross-reference specific paint system and application. Identify each material by manufacturer's catalog number and general classification.
2. Include test reports indicating compliance with test requirements specified.

B. Samples: For initial color selection, submit manufacturer's color charts. After color selection, submit color chips for surfaces to be painted. For verification, submit samples of each color and material to be applied with texture to simulate actual conditions on representative samples of actual substrate. Use representative colors when preparing samples for review. Resubmit samples until required sheen, color, and texture are achieved. Include a list of material and application for each coat of each sample, and label each sample as to location and application.

1. Submit stepped samples, defining each separate coat, including block fillers and primers.
2. Submit samples for Design Professional’s review of finish color and texture only, on following substrates, as applicable for each paint system.

a. On hardboard, submit 12" x 12" samples.
b. On actual wood surfaces, submit 4" x 8" samples.

c. On steel sheet, submit 4" x 4" samples.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats for each paint system. Use only thinners approved by paint manufacturer, and only within recommended limits.

B. Coordination of Work: Review other Sections in which primer paints are to be provided, to ensure compatibility of total paint system for each substrate. Upon request from other trades, furnish information or characteristics of finish materials, to ensure that compatible primer coats are used.

C. Applicator Qualifications: Engage an experienced applicator who has successfully completed projects similar in material and extent to that indicated for this Project.

D. Field Samples: On interior and exterior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 10 sq. ft. of surface until required sheen, color, and texture are achieved. Simulate finished lighting conditions for reviewing in-place work.

1. Final acceptance of colors will be from job-applied samples.
2. Architect will select one area or surface to represent surfaces and conditions for each type of coating and substrate to be coated. Apply coatings in this area or surface according to paint schedule, or as specified. After finishes are accepted, this area or surface will be used for evaluation of paint systems of a similar nature.

1.6 DELIVERY, STORAGE, HANDLING

A. Deliver materials to job-site in original, new and unopened packages and containers, bearing manufacturer's name and label, and following information.

1. Name or title of material.
2. Product description (generic classification and binder type).
3. Manufacturer's name, stock number, and date of manufacturer.
4. Contents by volume, for major pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. Handling instructions and precautions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.

1. Protect from freezing where necessary. Keep storage are a neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workers and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing, and application of paints.

1.7 PROJECT CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50°F (10°C) and 90°F (32°C), unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45°F (7°C) and 95°F (35°C), unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist: when relative humidity exceeds 85%; at temperatures less than 5°F (3°C) above dew point; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer's printed instructions.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing painting work.
2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within area can be maintained within limits specified by manufacturer during application and drying periods.

D. Comply with applicable VOC requirements and with manufacturer's recommendations to provide proper ventilation in all areas where work is being performed. Paints used for interior application must meet or exceed the VOC and chemical component limits of Green Seal requirements.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 TYPICAL PAINT MATERIALS

A. Acceptable Manufacturers: Products of Pittsburgh Paints (PPG) are named in this Section, to establish standards of quality required, except for special coatings and high-performance coatings. Proprietary names used to designate paint materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers. If acceptable to Design Professional, and subject to compliance with requirements, products of following companies may be used.

1. Benjamin Moore and Co.
2. Pratt & Lambert Paints
3. The Sherwin-Williams `Co. (SW)

PART 3 - EXECUTION

3.1 INSPECTION

A. Require applicator to examine areas and conditions under which painting work is to be applied, and notify Contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to applicator. Starting of painting work will be construed as applicator's acceptance of surfaces and conditions within any particular area.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.2 PREPARATION, GENERAL

A. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Design Professional in writing of any anticipated problems in using specified coating systems with substrates primed by others.
2. Remove hardware, accessories, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, re-install removed items.
3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

B. Prepare cementitious surfaces of concrete, concrete block, and cement plaster (if any) to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

1. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
2. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.

C. Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots; apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job-site. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, paneling.
2. Backprime all woodwork on backside prior to installation. When transparent finish is required, use spar varnish for backpriming.
3. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job-site.

D. Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

1. Touch-up shop-applied prime coats wherever damaged or bare, using same type of shop primer.

E. Clean galvanized surfaces to be free of oil and surface contaminants, using non-petroleum based solvent.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

D. Tint each undercoat, except primer, a lighter shade to facilitate identifying each coat where multiple coats of same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.4 APPLICATION, GENERAL

A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Provide finish coats which are compatible with prime paints used.

2. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry-film thickness equivalent to that of flat surfaces.
3. Paint surfaces behind movable equipment and furniture to be same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat non-specular black paint.
5. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
6. Finish exterior doors on tops, bottoms, and side edges to be same as exterior faces, unless otherwise indicated.
7. Sand lightly between each succeeding enamel or varnish coat.
8. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry-film thickness as indicated, or if not indicated, as recommended by coating manufacturer.

C. Apply prime coat to material which is required to be painted or finished, and which has not been prime coated by others.

1. For surfaces to receive wallcovering, if any, apply primer-sealer prior to installation of wallcovering.
2. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

D. Apply first-coat material to surfaces that have been cleaned, pre-treated, or otherwise prepared for painting, as soon as practicable after preparation and before subsequent surface deterioration.

E. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion of undercoat.

F. For pigmented (opaque) finishes, completely cover to provide an opaque, smooth 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.

G. For transparent (clear) finishes, use multiple coats to produce glass-smooth surface film of even luster. Provide a finish which is free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

H. On all new and existing fire-rated partitions (typically at perimeter of bathrooms with corridors and adjoining student rooms), provide stenciled markings above ceilings at a maximum 30 foot interval, in 0.5" high characters, "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS."

3.5 CLEAN-UP AND PROTECTION

A. During progress of the work, remove from job-site discarded paint materials, rubbish, cans, and rags at end of each work day.

1. Upon completion of painting work, clean glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and re-painting, as acceptable to Design Professional.

1. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
2. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.6 INTERIOR PAINT SCHEDULE

A. Concrete Block Filler:

1. Primer:1st Coat - PPG Speedhide Interior/Exterior Latex Block Filler 6-7.
2. Note: Provide block filler at all CMU walls.

B. Plaster, Drywall, Homasote, Masonry:

1. Primer: PPG Speedhide quick-drying interior latex primer – sealer 6-2 Minimum dry film (MDF) thickness 1.3 mil. Prime new work; spot-prime previously-painted surfaces where patched or as required.
2. Finish: Two coats (unless otherwise noted) PPG Speedhide 6-411 series vinyl acrylic latex eggshell. MDF 1.6 mil per coat.

C. Woodwork and Trim (Natural):

1. Primer: One coat PPG Olympic 42786 Satin Polyurethane Varnish.
2. Finish: Two coats PPG Olympic 42786 Satin Polyurethane Varnish.

D. Ferrous Metal:

1. Primer: One coat PPG Pitt-Tech Plus 90-912 Acrylic DTM Primer.
2. Finish: Two coats PPG Pitt-Tech Plus 90-1210 Series semi-gloss industrial enamel.

E. Galvanized Metal:

1. Primer: One coat PPG PittTech 90-712 Acrylic DTM Primer.
2. Finish: Two coats PPG Speedhide 6-1510 Alkyd WB Semi-Gloss Enamel.

END OF SECTION 099123

SECTION 12 36 61 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material apron fronts.
3. Solid surface material sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops, wall panel wrap and sinks. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Provide products by Arristech Surfaces LLC; Avonite or equal.

2. Color and Sheen: As selected by the Design Professional from manufacturers full range.
3. Type: Provide Standard type unless Special Purpose type is indicated.
4. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

C. Sink: Avonite Oval, or equal, as selected by the Design Professional.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration: Refer to Drawings

C. Countertops: 1-inch- thick, solid surface material laminated to ¾-inch thick plywood.

D. Joints: Fabricate countertops without joints.

E. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.

B. Install aprons to backing and countertops with adhesive.

C. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

D. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661

PLUMBING INDEX

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SECTION 22 05 00 - GENERAL PROVISIONS AND COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 Summary

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems
2. Transition fittings
3. Dielectric fittings
4. Mechanical sleeve seals
5. Sleeves
6. Escutcheons
7. Grout
8. Access Panels
9. Cleaning up/removal of debris
10. Equipment installation requirements common to equipment sections
11. Operating and maintenance data and owner instruction
12. Traps
13. Flashing
14. Painting and finishing
15. Concrete bases
16. Supports and anchorages
17. Materials prohibited
18. Certification

19. Guarantee of Work

20. Final plumbing connections

1.03 Definitions

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic

2. CPVC: Chlorinated polyvinyl chloride plastic

3. PE: Polyethylene plastic

4. PVC: Polyvinyl chloride plastic

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber

2. NBR: Acrylonitrile-butadiene rubber

H. The term "as indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.

I. It is the intention of these Contract Documents to call for finished work, tested and ready for operation.

1. The word "PROVIDE" shall mean "furnish and install, complete and ready for use" all items noted on the drawings and/or indicated in the Specifications.

2. The word "FURNISH" shall mean "supply and deliver to the job site" all items noted on the drawings and/or indicated in the Specifications. The items will be installed by the Owner or another contractor.

3. The word "INSTALL" shall mean "install complete and ready for use" all items furnished by the Owner or another contractor which are noted on the drawings and/or indicated in the Specifications to be installed by the Plumbing Contractor.

4. The word "RELOCATE" shall mean "move from the existing location to the new location installed complete and ready for use" all items noted on the drawings and/or indicated in the Specifications.

J. References made to Plumbing Contractor throughout Division 22 is intended to refer to the contractor or subcontractor who will furnish and install Plumbing materials and equipment.

1.04 Qualifications For Bidders

A. The Plumbing Contractor shall be experienced in work similar to that indicated for this Project and shall have a record of successful in-service performance.

B. Upon request, the Plumbing Contractor shall provide a listing of similar jobs with references.

C. Before submitting bid, the Plumbing Contractor shall visit the site and examine existing conditions on which his work is in any way dependent. The Plumbing Contractor shall immediately report to the Architect any condition which might prevent him from installing his equipment in the manner intended.

1.05 Bid Submission Requirements

A. The Plumbing Contractor shall submit his bid, including the Base Bid and all Alternate Bids, in accordance with the General Provisions of the Contract, including General, Supplementary and Special Conditions.

B. Only one manufacturer shall be listed for each equipment item.

1.06 Laws, Codes, and Regulations

A. All work shall be installed in accordance with accepted trade standards or practices. Accepted trade standards or practices shall be documented and shall be based on sound engineering design principles. Accepted trade standards or practices must include a statement indicating that the specific application in question is included within its scope. Accepted trade standards and practices must be documented through an engineering society or trade organization.

B. Failure to follow laws, codes, public regulations and accepted trade standards or practices will result in rejection of the work. All rejected work shall be removed and replaced at no additional cost to the Owner.

C. Nothing contained in these Specifications or shown on the Drawings shall be construed to be in conflict with state or local codes, ordinances or regulations governing the installation of the work specified herein. Should any change in the Drawings and/or Specifications be required in order to conform to the applicable codes, ordinances, regulations or laws, the Plumbing Contractor shall notify the engineer immediately upon discovery of the violation.

D. Products furnished for this project shall be "LEAD FREE" as required by Federal legislation passed on January 4, 2011. This entails the wetted surfaces of plumbing fixtures, equipment, valves, etc. described in each section to have a weighted-average lead content of no more than 0.25% when used in applications intended to convey or dispense water for human consumption through drinking or cooking.

1.07 Regulatory Requirements

A. Conform to applicable Building Codes

1. Commonwealth of Pennsylvania, Department of Labor and Industry.

a. Fire and Panic Regulations

b. Regulations Governing Boilers and Unfired Pressure Vessels

c. Elevator Law

B. Plumbing: Conform to NFPA 13, 14, and 20.

C. Plumbing: Conform to the 2015 International Plumbing Code and local amendments.

D. Energy conservation shall be provided for plumbing systems as described in the Pennsylvania Building Energy Conservation Act 222.

1.08 Permits, Fees, and Notices

A. The Plumbing Contractor shall give all requisite notices, obtain and pay all deposits and fees necessary for the installation, tests connections to the utility company service lines, street openings, repairs and inspection of all work provided under this Specification. These tests shall be conducted in the presence of the Architect.

1.09 Applicable Publications

A. The publications listed in each section form a part of that Section to the extent referenced.

B. The publication date is the publication in effect as of the bid date, except when a specific publication date is specified.

C. Obtain copies of referenced standards direct from publication source when needed for proper performance of work, or when required for submittal by Contract Documents.

1.10 Scope of Work

A. The work to be performed consists of the satisfactory completion of all Plumbing work, as indicated in the Contract Documents.

B. The work to be performed under these specifications shall include providing all labor, materials and equipment necessary to furnish and install, complete, properly and fully, all Plumbing Work as shown on drawings, herein specified and/or necessary thereto, whether or not specified herein in detail, and/or reasonably implied, and leaving the same in satisfactory operating condition. It is the intent of these specifications that a complete and operating system shall be installed and this Contractor shall carefully examine the site, plans, and specifications, and shall include all items necessary to accomplish this purpose.

1.11 Description of Systems

A. Without intending to limit or restrict the volume of work required by this Specification and the applicable drawings, the work generally consists of:

1. Complete Plumbing systems including sanitary, waste, vent, hot water and cold water piping, specialties, fixtures and equipment.

2. Complete water heating system including water heaters, pumps, piping and piping specialties (where required).

3. Thermal insulation of equipment and piping.

4. Concrete pads for all floor mounted equipment (where required).

5. Cleaning of all equipment, piping, and fixtures.

6. Painting of equipment, piping, supports and hangers.

7. Testing, balancing and adjusting.

8. Vibration isolation equipment (where required).

9. Structural and Mechanical Engineering services for the design and support of all piping systems for pipe sizes 6" and larger.

10. Operating and maintenance instructions and manuals.

11. Demonstration of successful system operation.

1.12 Equipment Furnished Under Other Contracts

A. Unless otherwise specified or shown on the drawings, this Contractor shall make final plumbing connections to all equipment furnished under General, HVAC and Electrical Contracts.

B. Unless otherwise specified or shown on drawings, the equipment furnished under the concurrent contracts will be furnished with their operating controls. This Contractor shall provide valves on water and gas, and unless otherwise shown or specified traps on waste outlets, and shall furnish all labor and materials required to connect the equipment and make it operative. Unless otherwise shown or specified valves on lines to equipment shall be ball valves.

C. Equipment furnished under other contracts will be set in place by the Contractor for that equipment. Controlling devices for this equipment will be furnished with the equipment, but were supplied detached, they shall be installed into the plumbing work piping assemblies by the Plumbing Contractor.

D. This Contractor shall refer to the shop drawings of equipment furnished under other contracts to obtain the locations of connections and arrangements of piping assemblies to which he is required to connect. All the required pipe, fittings, adapters, couplings and other accessories required to make the equipment operative shall be provided by this Contractor.

E. Products furnished to the site and paid for by the Owner.

1.13 Space Priority

A. Ensure equitable use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

1. Gravity flow piping systems.

2. Vent piping systems.

3. Ceiling recessed lighting fixtures.

4. Concealed air terminal units, fans.

5. Air duct systems.

6. Sprinkler systems piping.

7. Forced flow piping systems.

8. Electrical conduit, wiring, control wiring.

B. Order of priority does not dictate installation sequence. Installation sequence shall be as mutually agreed by all affected trades.

C. Change in order of priority is permissible by mutual agreement of all affected trades.

D. The work of a particular trade shall not infringe upon the allocated space of another trade without permission of the contractor for the affected trade.

E. The work of a particular trade shall not obstruct access for installation, operation and maintenance of the Work, materials and equipment of another trade.

F. This Contractor shall verify roughing-in dimensions for all fixtures and equipment prior to his roughing-in for such fixtures and equipment.

1.14 Record Drawings

A. The Plumbing Contractor shall:

1. During the construction period, maintain in good order a complete set of blue line Plumbing contract drawings. Record the actual Plumbing installation as the work progresses. Include all changes to the contract and to equipment sizes and types. Keep these drawings available at the site at all times for inspection.

2. Take proper caution against the use of superseded drawings. Check all such copies and mark "void". Where drawings have been corrected by memorandum, assume the responsibility for marking all drawings so affected with the changes; such marked drawings shall remain in use until revised drawings are issued.

3. At the conclusion of the work, this contractor shall furnish to the Architect a CD-Rom containing all of the Plumbing Drawings. The Drawings shall be in AutoCAD 2017 format and shall show all "as-built" conditions. The Drawings shall indicate all changes made during construction, including tagging and room names. The CD-Rom shall accompany the submission of the red lined Drawings required in Division 01.

4. Red line a clean set of Specifications to include approved substitutions, change orders, actual equipment and materials used and installed.

1.15 Intent of Drawings and Specifications

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable plumbing systems complete in every respect.

B. Any apparatus, appliance, material or work not shown as standard industry practice on drawings, but mentioned in the specifications, or vice versa, shall be provided by the Plumbing Contractor without additional expense to the Owner.

C. The drawings are diagrammatic, intending to show general arrangement and location of system components, and are not intended to be rigid in detail.

D. Due to the small scale of the drawings, all required offsets and fittings may not be shown but shall be provided at no change in Contract price.

E. As many of the small lines required for the complete installation are shown on the drawings as is practicable, but some may have been omitted. The Contractor shall do all such piping that may be required or directed to effect proper connections to all apparatus, equipment, and fixtures in accordance with the manufacturer's detailed drawings and instructions.

F. The equipment schedules shown on the drawings list the manufacturer used as the basis of design in the preparation of the Bid Drawings. The equipment specifications list that manufacturer as well as other manufacturers the Engineer, Architect and/or Owner find acceptable from a performance and product quality standpoint. Listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether they have a positive or negative monetary impact on the design shown on the Bid Drawings. In addition, listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether the dimensions of these products will have a negative impact on the space allotted for this equipment. If the Contractor or his Subcontractors decide to use a product or manufacturer that is listed as acceptable in the specifications but is different from the product or manufacturer scheduled on the drawings, it will be the responsibility of the Contractor or his Subcontractors to fully explore the product to ensure that it can be installed in the space allotted and shall pay any and all costs (including additional professional design fees) associated with the use of these products or manufacturers that impact the structure, the electrical system(s), the HVAC system(s) and/or the Plumbing system(s) due to an increase in weight, electrical load, drain and vent requirements, connection sizes, etc., between the scheduled item and the equipment item used.

1. Use of a product or manufacturer not scheduled on the Bid Drawings constitutes a representation that:

   a. The Plumbing Trade has investigated the proposed product and determined that the product can be installed within the space allotted.

   b. The Plumbing Trade will coordinate the installation of product used into the work

   c. The Plumbing Trade will be responsible for making all changes as may be required to make the work complete in all respects; waives all claims for additional costs under his responsibility, which may subsequently become apparent.

1.16 Submittals

A. This paragraph, entitled SUBMITTALS, lists general submittal requirements. The paragraph entitled SUBMITTALS, appearing in other sections of Division 22, identifies specific materials and equipment requiring submittals along with other submittal requirements. The Plumbing Contractor shall comply with all submittal requirements listed in this section of Division 22, other sections of Division 22, and General Conditions, Supplementary Conditions, Special Conditions and Division 1.

B. Where required, submit plans to the Pennsylvania Department of Labor and Industry (L&I) Boiler Division. Install water heaters, fired and unfired pressure vessels in conformance with approved drawings providing all required valves, platforms, ladders, exits and clearances. Submit approved L&I drawings to Architect before construction.

C. Submit Product Data, shop drawings, and samples in accordance with the General Conditions and Supplementary Conditions, within 60 days of award of contract for every item of material, etc. used.

D. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that reviewed shop drawings, product data and samples will be needed.

E. Shop Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Contract Drawings.

F. All drawings prepared by the Plumbing Contractor, for the Plumbing Contractor's use, shall be submitted for approval. Such drawings include, but are not limited to, pipe fabrication and layout drawings, Plumbing piping and layout drawings, equipment layout drawings, coordination drawings, and drawings of miscellaneous details.

G. Office samples shall be of sufficient size and quantity to clearly illustrate functional characteristics of the product, with integrally related parts and attachment devices, and full range of color, texture and pattern.

H. The Plumbing Contractor shall be responsible for reviewing shop drawings, product data and samples prior to submission. The Plumbing Contractor shall clearly mark or highlight the submittal to indicate all pertinent information such as model number, dimensions, capacities, clearances, performance characteristics, etc., and shall delete any data which is not relevant to the work. The Plumbing Contractor shall also determine and verify field measurements, field construction criteria, catalog numbers and similar data, and conformance with specifications.

I. The Plumbing Contractor shall coordinate each submittal with requirements of the work and of the Contract Documents.

J. The Plumbing Contractor shall notify the Architect in writing, at time of submission, of any deviations in the submittals from requirements of the Contract Documents.

K. The Plumbing Contractor shall begin no fabrication or work which requires submittals until return of submittals with Architect approval.

L. The Plumbing Contractor shall make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the work or in the work of any other Contractor.

M. Unless required otherwise by the General Conditions or the Supplementary Conditions, the number of submittals required shall be as follows:

1. Shop Drawings: Submit the number of opaque reproductions which the Plumbing Contractor requires, plus three copies, one will be retained by the Architect, one copy will be retained by the Engineer, and one copy will be retained by the Owner.

2. Product Data: Submit the number of copies which the Plumbing Contractor requires, plus three copies; one copy will be retained by the Architect, one copy will be retained by the Engineer, and one copy will be retained by the Owner.

3. Samples: Submit the number stated in each specification section.

N. The Plumbing Contractor shall also include in each submittal the date of submission and the dates of any previous submissions; the project title and number; the names of the Plumbing Contractor, the supplier, and the manufacturer; identification of the product, with the specification section number; identification of revisions on resubmittals; and the Plumbing Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

O. For resubmission requirements, the Plumbing Contractor shall make any corrections or changes in the submittals (i.e., shop drawings, samples or product data) required by the Architect and resubmit until approved.

P. The Architect will review submittals with reasonable promptness and in accordance with schedule, affix stamp and initials or signature, and indicate requirements for resubmittal, or approval of submittal, and return submittals to Plumbing Contractor for distribution, or for resubmission.

Q. Equipment and piping shop drawings shall be produced and submitted in accordance with the paragraphs in this section entitled "Coordination".

R. Submittals for equipment and pumps shall include manufacturer's published performance curves showing flow rate, pressure drop, efficiency, horsepower, NPSH required (for pumps), and operating points.

S. As soon as practicable, and within 30 days after the date of award of contract, and prior to installation of any equipment or material a completed schedule of equipment and material proposed for installation shall be submitted to the A/E for approval.

T. All material submitted for approval, excepting special equipment and special adaptation of regular equipment as hereinafter specified and as specifically shown on the drawings, shall be standard printed matter made available by the manufacturer to the public and in effect at the time of opening of bids and shall indicate that the material or equipment is regularly produced and recommended for the service required. In the event any items of material or equipment contained in the schedule fail to comply with the specification requirements, such items may be rejected.

U. In the event that the contractor fails to submit the required schedule of materials and equipment within the allowed time, the A/E will select a complete line of materials, fixtures, and equipment. The selection made shall be final and binding, and the items shall be furnished and installed by the contractor without any change in contract price or time of completion.

V. Product Data for the following:

1. Transition fittings

2. Dielectric fittings

3. Mechanical sleeve seals

4. Escutcheons

W. Welding certificates.

1.17 Substitutions and Product Options

A. It will be the responsibility of this contractor to pay any and all costs associated with any approved substitutions which impact the structure, the electrical system(s), the plumbing system(s) and/or the Plumbing system(s) due to an increase in weight, electrical load, drain requirements, connection sizes, etc., between the approved substitution item and the equipment item scheduled and/or indicated as the basis of design.

B. For products specified only by reference standard, select any product meeting that standard. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named, which complies with the drawings and specifications. For products specified by naming one or more products or manufacturers and "or equal", Plumbing Contractor must submit a request as for substitutions for any product or manufacturer not specifically named.

C. The Architect will consider written requests from the Plumbing Contractor for substitution of products by manufacturers not listed in the Specification for a period up to 10 days prior to the Bid. Within this period, submit a separate request for each product, supported with complete data, with drawings and samples as appropriate and as required under the "submittals" paragraph in this section to include: Comparison of the qualities of the proposed substitution with that specified; changes required in other elements of the work because of the substitution; effect on the construction schedule; cost data comparing the proposed substitution with the product specified; availability of maintenance service, and source of replacement materials.

D. A request for a substitution constitutes a representation that the Plumbing Contractor has investigated the proposed product and determined that it is equal to or superior in all respects to that specified; can be installed within the space allotted; will provide the same warranties or bonds for the substitution as for the product specified; will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects; waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

E. The Plumbing Contractor will compensate the Architect and Engineer on a time and material basis for their costs involved in reviewing a substitution.

1.18 Operating and Maintenance Data and Owner Instruction

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under this Contract in a neatly bound and tabulated format. The manual shall be bound in a standard one inch three-ring binder.

B. The manual shall contain as a minimum: models and serial numbers for the equipment; description of the equipment/system and its components; recommended routine, preventative and emergency maintenance; start-up, operating and safety instructions; recommended frequency of inspection; oil type; belt tension adjustment; performance curves, engineering data, and tests; "trouble-shooting guide"; a spare parts list; and names, addresses and telephone numbers for the equipment installer, the maintenance contractor, and the local spare parts source.

C. Provide complete operating and maintenance information for products specified in:

1. Section 22 05 23: General Duty Valves for Plumbing Piping

2. Section 22 05 29: Hangers and Supports for Plumbing Piping and Equipment

3. Section 22 05 53: Identification for Plumbing Piping and Equipment

4. Section 22 07 00: Plumbing Insulation

5. Section 22 11 16: Domestic Water Piping

6. Section 22 11 19: Domestic Water Piping Specialties

7. Section 22 13 16: Sanitary Waste and Vent Piping

8. Section 22 13 19: Sanitary Waste Piping Specialties

9. Section 22 40 00: Plumbing Fixtures

D. Submit one copy of completed operating and maintenance manual in pre-final form 30 days prior to final inspection or acceptance for approval. The copy will be returned before final inspection or acceptance, with comments.

E. Submit three (3) copies of revised operating and maintenance manual in final 10 days after return of the pre-final operating and maintenance manual.

F. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in order, adjustment and maintenance of products, equipment and systems. The instruction shall consist of a minimum of one 8-hour session on site. The session shall include a review of the contents of manual with personnel in full detail to explain all aspects of operations and maintenance. Instruction shall be arranged at the Owner's convenience.

1.19 Quality Assurance

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.20 Delivery, Storage, Handling, and Protection

A. Arrange deliveries of products in accordance with construction schedules. Coordinate to avoid conflict with work and conditions at the site. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

B. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

D. Deliver pipes and tubes with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

E. Store new products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store new products or items being re-used in a manner to prevent damage due to the elements, prevent damage due to construction operations at the site, and allow for ease of inspection.

F. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

G. The Plumbing Contractor, at his own expense, shall make good to the Architect and the Owner's satisfaction any damage to his work incurred by the action of the elements or any other cause due to the neglect on the part of the Plumbing Contractor or his representatives.

H. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.21 Protection of Services and Equipment

A. Repair, replace and maintain in service any utilities, facilities or services (underground, aboveground, interior and/or exterior) which are damaged, broken, or otherwise rendered inoperative during the course of construction. The method used in repairing, replacing or maintaining the services shall be approved by the Architect and/or Engineer.

B. The Plumbing Contractor shall protect all work, materials and equipment during the construction period. All openings must be securely covered, or otherwise protected, in order to prevent injury due to dropped tools, materials or dirt.

1.22 Special Conditions Related to Plumbing Work

A. During the course of construction, cap or otherwise seal off, in an approved manner, those portions of the piping system in which work is not being performed, in order to prevent the entry of dirt or dust.

B. The Plumbing Contractor shall coordinate all utility shutdowns with the Owner.

C. Install equipment along with control devices and all replaceable fittings with sufficient clearance for operation and maintenance functions.

D. Do not install piping in transformer vaults or electrical equipment rooms. In accordance with the National Electric Code Article 110-34f, do not install piping adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.

E. Exposed piping shall be run so as to allow maximum headroom consistent with proper pitch. Piping shall not interfere with any light, opening, door, window or equipment. Headroom in front of openings, doors and windows shall not be less than the top of the opening. Minimum clearance of 1 inch shall be maintained around all piping, valves and fittings.

F. Outside, underground piping shall have a minimum of 36 inches of earth cover, except provide greater coverage to equal locally recorded frost penetrations.

G. Lay out the work and establish all heights and grades required for installation.

H. All material and equipment to be furnished under this contract shall be new and shall conform to the grade, quality and standards specified herein. Items of equipment shall be the latest standard product as advertised in printed catalogues by reputable manufacturers for the purpose intended and shall have replacement parts available. All materials and equipment shall be American made.

I. Equipment shall be installed in strict accordance with the manufacturer's instructions for type and capacity of each piece of equipment. The Plumbing Contractor shall obtain these instructions from the manufacturer and such instructions shall be considered a part of these

specifications. Type, capacity, and application of equipment shall be suitable and capable of satisfactory operation for the purpose intended in the plumbing system.

J. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation, and maintenance.

K. It shall be the responsibility of the Contractor to ensure that the items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connection, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the drawings and specifications.

L. Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install that equipment to operate properly and in harmony with the intent of drawings and specifications. When directed by the Architect, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, ductwork, supports, insulation, wiring, heaters, panelboards, etc. He shall provide any additional motors, controllers, valves, fittings, and other additional equipment for the proper operation of the system resulting from the selection of that equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing-in and in connections by other trades. All changes shall be made at no increase in the Contract Amount or additional cost to the other trades.

M. Unless otherwise noted on the drawings or in the specifications, concrete pads and bases for heaters, tanks, and other equipment shall be furnished and installed by the Contractor furnishing the equipment requiring such pad or base. The Contractor shall establish sizes and locations of the various concrete bases required and shall provide all necessary anchor bolts, together with the templates for holding these bolts in position. Anchor bolts shall be placed in steel pipe sleeves to allow for adjustment, with suitable plate at bottom end of sleeve to hold the bolt. Each concrete base shall be not less than 4" high, which shall project 3" on all sides beyond the equipment. Special vibration isolation foundations that are required are specified with the equipment supported.

N. The Contractor shall support, plumb, rigid and true to line, all work and equipment furnished under each section. The Contractor shall study thoroughly all general, structural, mechanical, and electrical drawings, shop drawings, and catalog data to determine how equipment, fixtures, piping, conduit, ductwork, etc. are to be supported, mounted, or suspended and shall provide extra steel bolts, inserts, pipe standards, brackets and accessories for proper support, whether or not shown on the drawings. When directed, the Contractor shall submit prints showing supports for approval.

O. Provide safety guards for all pulleys, belt-drives and rotating equipment. Safety requirements of the Pennsylvania Department of Labor and Industry and OSHA shall be met.

1.23 Coordination

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

D. This Plumbing Contractor must cooperate completely and coordinate work with the General Trade and other trades providing equipment under this division and other divisions of the specifications.

E. Interference drawings shall be prepared as a combined effort of all trades. Each trade shall proceed with their own set of drawings on electronic backgrounds in AutoCAD Format 17 or later, prepared by the Mechanical Contractor. The Mechanical Contractor shall start their drawings immediately upon award of contract. Drawings shall be at 1/4" = 1'0" scale based on sheet size and plan location and orientation as shown on the architectural drawings. All interference drawings shall be capable of being overlaid to coordinate interferences and for printing. All congested areas and mechanical room plans shall be drawn at 3/8" = 1'0" scale.

F. After the Mechanical Contractor has finished, it shall forward one print along with an electronic file to the Plumbing trade that in turn will show and coordinate the plumbing work on the combined plans with the other trades. After the Plumbing trade has finished, it shall forward one print along with an electronic file to the Electrical trade that, in turn, will show and coordinate the electrical work on the combined plans with the other trades. After the Electrical trade has finished, it shall forward one print along with an electronic file to the Plumbing trade that, in turn, will show and coordinate the electrical work on the combined plans with the other trades.

G. Interference plans and elevations shall show in detail the location of the following items which require coordination because of size and proximity to other equipment and systems. Drawings shall show in order of installation priority within the allotted space the items prioritized in the paragraph entitled "Space Priority".

1. In addition, show mechanical and electrical work in equipment rooms.

2. On the interference drawings, show all electrical conduits which are 1-1/2" and larger.

H. Reproducible copies along with electronic file of the finished interference drawings shall be submitted to the Architect for record and approval before actual installation work begins. Each trade shall make completed interference drawings available to their craft for installation of the work.

I. Individual trade interference drawings may be used as shop drawings and/or as record drawings at the completion of the project.

PART 2 PRODUCTS

2.01 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 Pipe, Tube, and Fittings

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory threaded pipe and pipe fittings.

2.03 Joining Materials

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

   a. Full-Face Type: For flat-face, Class 125, cast iron and cast-bronze flanges.

   b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235

2. CPVC Piping: ASTM F 493

3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656

4. PVC to ABS Piping Transition: ASTM D 3138

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.04 Transition Fittings

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Company

b. Dresser Industries, Inc.; DMD Division

c. Ford Meter Box Company, Inc. (The); Pipe Products Division

d. JCM Industries

e. Smith-Blair, Inc.

f. Viking Johnson

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

    a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

    a. Nibco, Inc.

    b. Nibco, Inc.; Chemtrol Division

E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

    a. Cascade Waterworks Mfg. Company

    b. Fernco, Inc.

    c. Mission Rubber Company

    d. Plastic Oddities, Inc.

2.05 Dielectric Fittings

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory fabricated, union assembly, for 250-psig minimum working pressure at 180°F.

1. Manufacturers:

    a. Capitol Manufacturing Company

    b. Central Plastics Company

    c. Eclipse, Inc.

    d. Epco Sales, Inc.

    e. Hart Industries, International, Inc.

    f. Watts Industries, Inc.; Water Products Division

g. Zurn Industries, Inc.; Wilkins Division

D. Dielectric Flanges: Factory fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Company

b. Central Plastics Company

c. Epco Sales, Inc.

d. Watts Industries, Inc.; Water Products Division

E. Dielectric Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Central Plastics Company

d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225°F.

1. Manufacturers:

a. Calpico, Inc.

b. Lochinvar Corporation

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225°F.

1. Manufacturers:

a. Perfection Corporation

b. Precision Plumbing Products, Inc.

c. Sioux Chief Manufacturing Co., Inc.

d. Victaulic Company of America

2.06 Mechanical Sleeve Seals

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Company

d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.07 Sleeves

A. Galvanized Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

H. Sleeves for Pipes through Non-Fire Rated Walls and Floors: Form with galvanized steel.

I. Sleeves for Pipes through Exterior Masonry and Concrete Walls and Slabs below Grade: Form with schedule 40 steel pipe with water stops.

J. Sleeves for Pipes through Masonry and Concrete Walls and Slabs above Grade: Form with Schedule 40 steel pipe.

K. Sleeves for Pipe through Drywall and Plaster Partitions: Form with galvanized steel.

L. Provide Link-Seal by Thunderline Corporation for below grade piping penetrations through exterior walls and slabs.

2.08 Escutcheons

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome plated finish.

C. One-Piece, Cast brass Type: With set screw.

1. Finish: Polished chrome plated and rough brass.

D. Split-Casting, Cast brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome plated and rough brass.

E. One-Piece, Stamped steel Type: With set screw or spring clips and chrome plated finish.

F. Split-Plate, Stamped steel Type: With concealed hinge, set screw or spring clips, and chrome plated finish.

G. One-Piece, Floor plate Type: Cast iron floor plate.

H. Split-Casting, Floor plate Type: Cast brass with concealed hinge and set screw.

2.09 Grout

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

2.10 Access Panels

A. Where required for access to valves, cleanouts, etc., and where new and existing items require adjustments, inspection or service, removable panels complete with frame shall be furnished and installed by this Contractor. Access panels shall be a minimum of 10" x 10". Panels are required for their intended service and shall be of the type, fire rating, finish, color and material required for the finish and construction into which they are installed. Coordinate with General Contractor and Architect prior to purchasing.

B. Access panels shall be a minimum of 18" x 18" or larger where needed to remove equipment and allow man access. Doors shall be hinged and removable.

PART 3 EXECUTION

3.01 Cleaning Up/Removal of Debris

A. This Contractor shall periodically, and at such times as directed by the Professional, remove from the premises all trash and debris caused by the performance of his work. At the completion of the work, all parts of the plumbing installation shall by thoroughly cleaned by this Contractor. All piping, flush valves, fixtures, trim, strainers, etc., shall be cleaned of all grease, dirt and metal cuttings. All plumbing fixtures shall be cleaned to restore to their original condition.

B. Any damage to the building finishes or furnishings due to the failure of this Contractor to afford proper protection during the execution of his work, shall be restored in a manner satisfactory to the Architect/Owner.

3.02 Piping Systems - Common Requirements

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Water piping shall be graded in such a manner as to be completely drain the entire system and to permit air relief of hot water piping systems.

L. Select system components with pressure rating equal to or greater than system operating pressure.

M. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome plated Piping: One-piece, cast brass type with polished chrome plated finish.

c. Insulated Piping: One-piece, stamped steel type with spring clips.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast brass type with polished chrome plated finish.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast brass type with polished chrome plated finish.

f. Bare Piping in Unfinished Service Spaces: One-piece, cast brass type with polished chrome plated or rough-brass finish.

g. Bare Piping in Equipment Rooms: One-piece, cast brass type.

h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor plate type.

N. Sleeves are not required for core-drilled holes.

O. Permanent sleeves are not required for holes formed by removable PE sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

   b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

      1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

R. Aboveground, Exterior Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Underground, Exterior-Wall Pipe Penetrations: Install cast iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

T. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

W. Exposed piping in finished spaces shall be chrome-plated.

3.03 Piping Joint Construction

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Non-pressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain End Pipe and Fittings: Use butt fusion.

2. Plain End Pipe and Socket Fittings: Use socket fusion.

3.04 Piping Connections

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.05 Equipment Installation - Common Requirements

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.06 Starting of Plumbing Systems and Equipment

A. Provide material and labor required to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures. Refer to the section in Division 22 in which the system or equipment item is specified for specific start-up requirements for that system or equipment item.

3.07 Traps

A. Unless otherwise specified or shown on the drawings, all plumbing fixtures, floor drains, and equipment furnished by this or other current contracts shall be individually trapped with full bore traps. Generally, plumbing fixture traps shall be on the wall outlet type connecting to a sanitary tee drainage fitting, the vent being extended vertically and provided with offsets where shown or specified.

B. Traps supplied with the plumbing fixtures are specified elsewhere; however, all equipment furnished under other contracts and requiring waste connections and not furnished with traps, shall be provided with traps furnished and installed by this Contractor. All unburied traps shall be cast brass of the sizes shown on the drawings, and shall, where exposed, be chrome plated and connected to the roughing with chrome plated copper tubing. Buried traps shall be cast iron.

C. Where buried, running traps shall have one vent hub fitted with extension section of pipe to permit cleanout plug to be installed under cover plate, set flush with finished floor. All unburied P-traps shall have cleanout plug on the bottom of the bed of the trap. Buried P-traps shall not have cleanout plugs.

3.08 Flashing

A. Openings in roofs for extended soil and vent pipe shall be flashed by the General Contractor. Refer to detail on Architectural drawings.

3.09 Painting

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory painted finishes with materials and procedures to match original factory finish.

3.10 Concrete Bases

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor bolt manufacturer's written instructions.

7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete".

3.11 Erection of Metal Supports and Anchorages

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.12 Erection of Wood Supports and Anchorages

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.13 Grouting

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.14 Materials Prohibited

A. Absolutely no materials, equipment, etc., containing asbestos and/or lead shall be installed on this construction project. No deviations will be entertained or accepted.

3.15 Certification

A. After a final site observation has been performed by the engineer, the contractor shall provide the Owner with a letter certifying that he did not install any asbestos containing and/or lead containing materials on this projects a result of his construction work. In addition, the contractor shall provide the owner with a letter from each of his sub-contractors certifying the same.

3.16 Guarantee of Work

A. Where applicable, furnish manufacturer's written warranty for materials and equipment.

B. Comply, also, with the General Conditions and the Supplementary Conditions and the applicable Section of Division 1, General Requirements.

C. This Plumbing Contractor shall furnish a written warranty stating that all work shall be free from defects of equipment, material for workmanship for a period of one year from date of final acceptance and all defects developing during that period shall be made good without cost to the Owner.

D. This Plumbing Contractor shall service the installation for one year from date of final acceptance. This shall include all emergency service and adjustment, with the exception of the oiling of motors and cleaning of filters and screens.

3.17 Final Plumbing Connections

A. Provide rough-in and final connection of all Plumbing services needed for equipment provided by the Owner or by other trades. Shop Drawings will be furnished by those providing the equipment. These Drawings shall be checked by the trade responsible for rough-in and final connections before submission to the Architect for approval. The work shall be done in accordance with the approved Shop Drawings.

B. In general, connection and termination points are given in the Contract Documents. Where not given or where conflicts occur, refer the question to the Architect for a binding decision.

END OF SECTION 22 05 00

SECTION 22 05 23 - GENERAL - DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 Summary

A. This Section includes the following general-duty valves:

1. Bronze angle valves
2. Cast iron angle valves
3. Copper alloy ball valves
4. Ferrous alloy ball valves
5. Ferrous alloy butterfly valves
6. Bronze check valves
7. Gray iron swing check valves
8. Spring-loaded, lift disc check valves
9. Bronze gate valves
10. Cast iron gate valves
11. Bronze globe valves
12. Cast iron globe valves
13. Cast iron plug valves
14. Chain wheel actuators

B. Products furnished for this project shall be "LEAD FREE" as required by Federal legislation passed on January 4, 2011. This entails the wetted surfaces of plumbing fixtures, equipment, valves, etc. described in this section to have a weighted-average lead content of no more than 0.25% when used in applications intended to convey or dispense water for human consumption through drinking or cooking.

C. Related Sections include the following:

1. Division 22 Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and charts.

2. Division 22 piping Sections for specialty valves applicable to those Sections only.

1.03 Definitions

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure

2. EPDM: Ethylene-propylene-diene terpolymer rubber

3. NBR: Acrylonitrile-butadiene rubber

4. PTFE: Polytetrafluoroethylene plastic

5. TFE: Tetrafluoroethylene plastic

1.04 Submittals

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.05 Quality Assurance

A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.06 Delivery, Storage, and Handling

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.

3. Set angle, gate, and globe valves closed to prevent rattling.

4. Set ball and plug valves open to minimize exposure of functional surfaces.

5. Set butterfly valves closed or slightly open.

6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 Valves - General

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valves shall be of the “LEAD FREE” design.

G. Valve Actuators:

1. Chain wheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.

2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.

3. Hand wheel: For valves other than quarter-turn types.

4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.

5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

H. Extended Valve Stems: On insulated valves.

I. Valve Flanges: ASME B16.1 for cast iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

J. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

    a. Caution: Use solder with melting point below 840°F for angle, check, gate, and globe valves; below 421°F for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

K. Valve Bypass and Drain Connections: MSS SP-45.

2.03 Bronze Angle Valves

A. Manufacturers:

1. Type 2, Bronze Angle Valves with Nonmetallic Disc:

    a. Cincinnati Valve Company

    b. Crane Company; Crane Valve Group; Stockham Division

    c. Grinnell Corporation

    d. Hammond Valve

    e. Nibco, Inc.

B. Bronze Angle Valves, General: MSS SP-80, with ferrous alloy hand wheel.

C. Type 2, Class 125, Bronze Angle Valves: Bronze body with PTFE or TFE disc and union-ring bonnet.

D. Type 2, Class 150, Bronze Angle Valves: Bronze body with PTFE or TFE disc and union-ring bonnet.

2.04 Cast Iron Angle Valves

A. Manufacturers:

1. Type II, Cast iron Angle Valves with Metal Seats:

    a. Crane Company; Crane Valve Group; Stockham Division

    b. Nibco, Inc.

B. Cast iron Angle Valves, General: MSS SP-85, Type II.

C. Class 125, Cast iron Angle Valves: Bronze mounted with gray iron body and bronze seats.

2.05 Copper Alloy Ball Valves

A. Manufacturers:

1. Two-Piece, Copper alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Division

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation

d. Hammond Valve

e. Milwaukee Valve Company

f. Nibco, Inc.

g. Watts Industries, Inc.; Water Products Division

B. Copper alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper alloy Ball Valves: Bronze body with regular-port, chrome plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.

2.06 Ferrous Alloy Ball Valves

A. Manufacturers:

1. Conbraco Industries, Inc.; Apollo Division

2. Crane Company; Crane Valve Group; Stockham Division

3. Hammond Valve

4. Milwaukee Valve Company

5. Nibco, Inc.

B. Ferrous alloy Ball Valves, General: MSS SP-72, with flanged ends.

C. Ferrous alloy Ball Valves: Class 150, full or regular port.

2.07 Ferrous Alloy Butterfly Valves

A. Manufacturers:

1. Flangeless, Ferrous alloy Butterfly Valves:

a. Crane Company; Crane Valve Group; Stockham Division

b. Grinnell Corporation

c. Hammond Valve

d. Milwaukee Valve Company

e. Mueller Steam Specialty

f. Nibco, Inc.

g. Watts Industries, Inc.; Water Products Division

2. Single Flange, Ferrous alloy Butterfly Valves:

a. Crane Company; Crane Valve Group; Stockham Division

b. Grinnell Corporation

c. Hammond Valve

d. Milwaukee Valve Company

e. Mueller Steam Specialty.

f. Nibco, Inc.

g. Watts Industries, Inc.; Water Products Division

3. Flanged, Ferrous alloy Butterfly Valves:

a. Grinnell Corporation

b. Mueller Steam Specialty

c. Tyco International, Ltd.; Tyco Valves & Controls.

4. Grooved End, Ductile-Iron Butterfly Valves:

a. Grinnell Corporation

b. Hammond Valve

c. McWane, Inc.; Kennedy Valve Division

d. Milwaukee Valve Company

e. Mueller Steam Specialty

f. Nibco, Inc.

g. Victaulic Company of America

B. Ferrous alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.

C. Flangeless, 200-psig (1380-kPa) CWP Rating, Ferrous alloy Butterfly Valves: Wafer type with one- or two-piece stem.

D. Single flange, 200-psig (1380-kPa) CWP Rating, Ferrous alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.

E. Flanged, 200-psig (1380-kPa) CWP Rating, Ferrous alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.

F. Grooved End, 175-psig (1207-kPa) CWP Rating, Ferrous alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.

2.08 Bronze Check Valves

A. Manufacturers:

1. Type 3, Bronze, Swing Check Valves with Metal Disc:

   a. Cincinnati Valve Company

   b. Crane Company; Crane Valve Group; Stockham Division

   c. Grinnell Corporation

   d. Hammond Valve

   e. Milwaukee Valve Company

   f. Nibco, Inc.

   g. Watts Industries, Inc.; Water Products Division

2. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:

   a. Cincinnati Valve Company

   b. Crane Company; Crane Valve Group; Stockham Division

   c. Grinnell Corporation

   d. Hammond Valve

   e. Milwaukee Valve Company

   f. Nibco, Inc.

   g. Watts Industries, Inc.; Water Products Division

B. Bronze Check Valves, General: MSS SP-80.

C. Type 3, Class 125, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

D. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

E. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

F. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.09 Gray Iron Swing Check Valves

A. Manufacturers:

1. Type I, Gray iron Swing Check Valves with Metal Seats:

a. Cincinnati Valve Company

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation

d. Hammond Valve

e. Milwaukee Valve Company

f. Mueller Company

g. Nibco, Inc.

h. Watts Industries, Inc.; Water Products Division

2. Type II, Gray iron Swing Check Valves with Composition to Metal Seats:

a. Crane Company; Crane Valve Group; Stockham Division

b. Mueller Company

c. Watts Industries, Inc.; Water Products Division

3. Grooved End, Ductile-Iron Swing Check Valves:

a. Grinnell Corporation

b. Mueller Company

c. Victaulic Company of America

B. Gray Iron Swing Check Valves, General: MSS SP-71.

C. Type I, Class 125, gray iron, swing check valves with metal seats.

D. Type II, Class 125, gray iron, swing check valves with composition to metal seats.

E. No manufacturers for valves in first paragraph below were located. Verify availability if required.

F. 175-psig (1207-kPa) CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.10 Spring Loaded, Lift Disc Check Valves

A. Manufacturers:

1. Type II, Compact Wafer, Lift disc Check Valves:

a. Grinnell Corporation

b. Hammond Valve

c. Milwaukee Valve Company

d. Mueller Steam Specialty

e. Nibco, Inc.

2. Type III, Globe Lift disc Check Valves:

a. Grinnell Corporation

b. Hammond Valve

c. Milwaukee Valve Company

d. Nibco, Inc.

3. Type IV, Threaded Lift disc Check Valves:

a. Grinnell Corporation

b. Milwaukee Valve Company

c. Mueller Steam Specialty

d. Nibco, Inc.

e. Watts Industries, Inc.; Water Products Division

B. Lift disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

C. Type II, Class 125, Compact-Wafer, Lift disc Check Valves: Compact-wafer style with cast iron shell with diameter made to fit within bolt circle.

D. Type III, Class 125, Globe Lift disc Check Valves: Globe style with cast iron shell and flanged ends.

E. Type IV, Class 125, Threaded Lift disc Check Valves: Threaded style with bronze shell and threaded ends.

F. Type IV, Class 150, Threaded Lift disc Check Valves: Threaded style with bronze shell and threaded ends.

2.11 Bronze Gate Valves

A. Manufacturers:

1. Type 1, Bronze, Non-rising Stem Gate Valves:

a. Cincinnati Valve Company

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation

d. Hammond Valve

e. Milwaukee Valve Company

f. Nibco, Inc.

g. Watts Industries, Inc.; Water Products Division

2. Type 2, Bronze, Rising Stem, Solid-Wedge Gate Valves:

a. Cincinnati Valve Company

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation

d. Hammond Valve

e. Milwaukee Valve Company

f. Nibco, Inc.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous alloy handwheel.

C. Type 1, Class 125, Bronze Gate Valves: Bronze body with non-rising stem and bronze solid wedge and union-ring bonnet.

D. Type 1, Class 150, Bronze Gate Valves: Bronze body with non-rising stem and bronze solid wedge and union-ring bonnet.

E. Type 2, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

F. Type 2, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

2.12 Cast Iron Gate Valves

A. Manufacturers:

1. Type I, Cast iron, Non-rising stem Gate Valves:

a. Cincinnati Valve Company

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation.

d. Hammond Valve.

e. Milwaukee Valve Company.

f. Nibco, Inc.

g. Watts Industries, Inc.; Water Products Division

2. Type I, Cast iron, Rising-Stem Gate Valves:

a. Cincinnati Valve Company

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation.

d. Hammond Valve.

e. Milwaukee Valve Company.

f. Nibco, Inc.

g. Watts Industries, Inc.; Water Products Division

B. Cast iron Gate Valves, General: MSS SP-70, Type I.

C. Class 125, NRS, Bronze mounted, Cast iron Gate Valves: Cast iron body with bronze trim, non-rising stem, and solid-wedge disc.

D. Class 125, OS&Y, Bronze mounted, Cast iron Gate Valves: Cast iron body with bronze trim, rising stem, and solid-wedge disc.

E. Class 125, NRS, All-Iron, Cast iron Gate Valves: Cast iron body with cast iron trim, non-rising stem, and solid-wedge disc.

F. Class 125, OS&Y, All-Iron, Cast iron Gate Valves: Cast iron body with cast iron trim, rising stem, and solid-wedge disc.

2.13 Bronze Globe Valves

A. Manufacturers:

1. Type 1, Bronze Globe Valves with Metal Disc:

a. Cincinnati Valve Company

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation.

d. Hammond Valve.

e. Milwaukee Valve Company.

f. Nibco, Inc.

2. Type 2, Bronze Globe Valves with Nonmetallic Disc:

a. Cincinnati Valve Company

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation

d. Hammond Valve

e. Milwaukee Valve Company

f. Nibco, Inc.

B. Bronze Globe Valves, General: MSS SP-80, with ferrous alloy handwheel.

C. Type 1, Class 125, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

D. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

E. Type 2, Class 125, Bronze Globe Valves: Bronze body with PTFE or TFE disc and union-ring bonnet.

F. Type 2, Class 150, Bronze Globe Valves: Bronze body with PTFE or TFE disc and union-ring bonnet.

2.14 Cast Iron Globe Valves

A. Manufacturers:

1. Type I, Cast iron Globe Valves with Metal Seats:

a. Cincinnati Valve Company

b. Crane Company; Crane Valve Group; Stockham Division

c. Grinnell Corporation

d. Hammond Valve

e. Milwaukee Valve Company

f. Nibco, Inc.

B. Cast iron Globe Valves, General: MSS SP-85.

C. Type I, Class 125, Cast iron Globe Valves: Gray iron body with bronze seats.

2.15 Cast Iron Plug Valves

A. Manufacturers:

1. Lubricated Type, Cast iron Plug Valves:

a. Milliken Valve Company, Inc.

b. Nordstrom Valves, Inc.

c. Olson Technologies; Homestead Division

d. R & M Energy Systems (Tomball, TX).

e. Walworth Company

B. Cast iron Plug Valves, General: MSS SP-78.

C. Class 125 or 150, lubricated type, cast iron plug valves.

2.16 Chain wheel Actuators

A. Manufacturers:

1. Babbitt Steam Specialty Company

2. Roto Hammer Industries, Inc.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: Bronze, of type and size required for valve. Include zinc coating.

2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.

3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 EXECUTION

3.01 Examination

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.02 Valve Applications

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.

2. Throttling Service: Angle, ball, butterfly, or globe valves.

3. Pump Discharge: Spring-loaded, lift disc check valves.

B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves with "LEAD FREE" design:

1. Angle Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 125, bronze.

2. Angle Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, cast iron.

3. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, copper alloy.

4. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.

5. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Flangeless, Single flange or Flanged, 200-psig (1380-kPa) CWP rating, ferrous alloy, with EPDM liner.

6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa).

7. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 125, bronze.

8. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.

9. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa) CWP rating.

10. Spring-Loaded, Lift disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 125 minimum.

11. Spring-Loaded, Lift disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II or III, Class 125, cast iron.

12. Gate Valves, NPS 2 (DN 50) and Smaller: Type 1 or 2, Class 200, bronze.

13. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, NRS, bronze mounted cast iron.

14. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 125, bronze.

15. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze mounted cast iron.

16. Plug Valves, NPS 2 (DN 50) and Larger: Class 125 or 150, lubricated-type with FDA-approved-material sealant, cast iron.

D. Sanitary Waste and Storm Drainage Piping: Use the following types of valves:

1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, copper alloy.

2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.

3. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 3 or 4, Class 125, bronze.

4. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type I or II, Class 125, gray iron.

5. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa) minimum CWP rating.

6. Gate Valves, NPS 2 (DN 50) and Smaller: Type 1 or 2, Class 125, bronze.

7. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, NRS, bronze mounted cast iron.

8. Globe Valves, NPS 2 (DN 50) and Smaller: Type 1 or 2, Class 125, bronze.

9. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, cast iron.

10. Plug Valves, NPS 2 (DN 50) and Larger: Class 125 or 150, lubricated-type, cast iron.

E. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint or threaded ends.

2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.

3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.

4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.

6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

7. For Grooved-End, Steel Piping: Valve ends may be grooved.

3.03 Valve Installation

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chain wheel operators on valves NPS 4 (DN 100) and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

2. Dual Plate Check Valves: In horizontal or vertical position, between flanges.

3. Lift Check Valves: With stem upright and plumb.

3.04 Joint Construction

A. Refer to Division 22 Section 22 05 00 "General Provisions and Common Work Results for Plumbing" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water flushable, lead free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.05 Adjusting

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 *Summary*

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.

2. Trapeze pipe hangers.

3. Metal framing systems.

4. Thermal hanger shield inserts.

5. Fastener systems.

6. Pipe stands.

7. Pipe positioning systems.

8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.03 *Definitions*

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 *Performance Requirements*

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 *Submittals*

A. Product Data: For the following:

1. Steel pipe hangers and supports.

2. Thermal hanger shield inserts.

3. Powder actuated fastener systems.

4. Pipe positioning systems.

B. Welding certificates.

1.06 *Quality Assurance*

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

2. AWS D1.2, "Structural Welding Code--Aluminum."

3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 *Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 *Steel Pipe Hangers and Supports*

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.

2. Bergen-Power Pipe Supports

3. B-Line Systems, Inc.; a division of Cooper Industries

4. ERICO/Michigan Hanger Company

5. Globe Pipe Hanger Products, Inc.

6. Grinnell Corporation
7. National Pipe Hanger Corporation
8. PHD Manufacturing, Inc.
9. PHS Industries, Inc.
10. Piping Technology & Products, Inc.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with pipe insulation pad or cushion for support of bearing surface of piping.

2.03 *Trapeze Pipe Hangers*

A. Description: MSS SP-69, Type 59, shop or field fabricated pipe support assembly made from structural steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.04 *Metal Framing Systems*

A. Description: MFMA-3, shop or field fabricated pipe support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries
2. ERICO/Michigan Hanger Co.; ERISTRUT Division
3. Power-Strut Division; Tyco International, Ltd.
4. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.05 *Thermal Hanger Shield Inserts*

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Company

2. PHS Industries, Inc.

3. Pipe Shields, Inc.

C. Insulation Insert Material for Cold Piping: Water repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

D. Insulation Insert Material for Hot Piping: Water repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.06 *Fastener Systems*

A. Powder Actuated Fasteners: Threaded steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.

b. ITW Ramset/Red Head

c. Masterset Fastening Systems, Inc.

d. Powers Fasteners

B. Mechanical Expansion Anchors: Insert-wedge-type zinc coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries

b. Hilti, Inc.

c. ITW Ramset/Red Head

d. Powers Fasteners

2.07 *Pipe Stand Fabrication*

A. Pipe Stands, General: Shop or field fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Company

b. MIRO Industries

C. Low type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:

a. MIRO Industries

D. High Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Company

b. MIRO Industries

c. Portable Pipe Hangers

2. Base: Plastic or Stainless steel.

3. Vertical Members: Two or more cadmium plated steel or stainless steel, continuous-thread rods.

4. Horizontal Member: Cadmium plated steel or stainless steel rod with plastic or stainless steel, roller-type pipe support.

E. High Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:

a. Portable Pipe Hangers.

2. Bases: One or more plastic.

3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized steel, clevis-type pipe hangers.

F. Curb Mounting Type Pipe Stands: Shop- or field fabricated pipe support made from structural steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.08 *Pipe Positioning Systems*

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corporation

2. HOLDRITE Corp.; Hubbard Enterprises

3. Samco Stamping, Inc.

2.09 *Equipment Supports*

A. Description: Welded, shop or field fabricated equipment support made from structural steel shapes.

2.10 *Miscellaneous Materials*

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

3.01 *Hanger and Support Applications*

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120° to 450°F pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).

8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).

10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).

11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).

12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast iron floor flange.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast iron floor flange and with U-bolt to retain pipe.

16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.

17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

    1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).

    2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

    1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

    2. Steel Clevises (MSS Type 14): For 120° to 450°F piping installations.

    3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

    4. Malleable Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120° to 450°F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.

    b. Medium (MSS Type 32): 1500 lb.

    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.

b. Vertical (MSS Type 55): Mounted vertically.

c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder actuated fasteners or mechanical expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.02 *Hanger and Support Installation*

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field assembled metal framing systems.

D. Thermal hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.

2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section 22 40 00 "Plumbing Fixtures" for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

   b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.

   c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe - not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.

    b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.

    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.

    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.

    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal hanger Shields: Install with insulation same thickness as piping insulation.

3.03 *Equipment Supports*

A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 *Metal Fabrications*

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 *Adjusting*

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous thread hanger and support rods to 1-1/2 inches.

3.06 *Painting*

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 *Summary*

A. Section Includes:

1. Equipment labels
2. Warning signs and labels
3. Pipe labels
4. Valve tags
5. Warning tags

1.03 *Submittals*

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.04 *Coordination*

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 *Equipment Labels*

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having pre-drilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: Black.

3. Background Color: White.

4. Maximum Temperature: Able to withstand temperatures up to 160°F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 x 11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 *Warning Signs and Labels*

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160°F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 *Pipe Labels*

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.04 *Valve Tags*

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve tag schedule shall be included in operation and maintenance data.

2.05 *Warning Tags*

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 EXECUTION

3.01 *Preparation*

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 *Equipment Label Installation*

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 *Pipe Label Installation*

A. Piping Color Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Cold Water Piping:

   a. Background Color: Green

   b. Letter Color: White

2. Hot Water Supply Piping:

   a. Background Color: Yellow

   b. Letter Color: Black

3. Hot Water Re-circulation Piping:

   a. Background Color: Yellow

   b. Letter Color: Black

4. Storm Drainage Piping:

   a. Background Color: Green

   b. Letter Color: White

5. Sanitary Waste Drainage Piping:

   a. Background Color: Green

b. Letter Color: White

6. Natural Gas Piping:

a. Background Color: Yellow

b. Letter Color: Black

3.04 *Valve Tag Installation*

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory fabricated equipment units; shutoff valves; faucets; convenience and lawn watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve Tag Size and Shape:

a. Cold Water: 2 inches round

b. Hot Water: 2 inches round

2. Valve Tag Color:

a. Cold Water: Green

b. Hot Water: Green

3. Letter Color:

a. Cold Water: White

b. Hot Water: White

3.05 *Warning Tag Installation*

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 *Summary*

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber

b. Noncombustible barrier for combustible (plastic) pipe in noncombustible construction.

2. Insulating cements

3. Adhesives

4. Lagging adhesives

5. Sealants

6. Factory applied jackets

7. Tapes

8. Securements

9. Corner angles

1.03 *Submittals*

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets.

B. Qualification Data: For qualified Installer.

C. Field quality control reports.

1.04 *Quality Assurance*

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft-training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire Test Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.

2. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

1.05 *Delivery, Storage, and Handling*

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 *Coordination*

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.07 *Scheduling*

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.01 *Insulation Materials*

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fibrex Insulations Inc.; Coreplus 1200.

b. Johns Manville; Micro-Lok.

c. Knauf Insulation; 1000 (Pipe Insulation).

d. Manson Insulation Inc.; Alley-K.

2. Type I, 850°F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory applied ASJ. Factory applied jacket requirements are specified in "Factory Applied Jackets" Article.

G. Mineral Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100°F is 0.29 Btu x in./h x sq. ft. x degree F or less. Factory applied jacket requirements are specified in "Factory Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CrimpWrap.

b. Johns Manville; MicroFlex.

c. Knauf Insulation; Pipe and Tank Insulation.

d. Manson Insulation Inc.; AK Flex.

e. Owens Corning; Fiberglas Pipe and Tank Insulation.

H. Noncombustible barrier for combustible (plastic) pipe in noncombustible construction: (To be used on exhaust and intake piping from water heaters).

1. Color: Fiber/white, foil/silver to gray.

2. Density: 6 pcf.

3. Flame Spread (UL 723/ASTM E-84): 0.

4. Smoke Developed (UL 723/ASTM E-84): 0.
5. Fuel Contributed (UL 723/ASTM E-84): 0.
6. Thermal Resistance (ASTM C518): 4.2.
7. Operating Temperature: 2,300°F.
8. Melt Point: 3,100°F.
9. Max. Flame Spread (UL 1887): 0 (ft.).
10. Max. Smoke/optical density (UL 1887): 01.
11. Average Smoke (UL 1887): 0.
12. Test Standard: Foil on both sides tested to UL 1887 test procedure, a modified tunnel test which provides data for flame spread and smoke density.

2.02 *Insulating Cements*

A. Mineral Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Insulco, Division of MFS, Inc.; Triple I.

b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Mineral fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Insulco, Division of MFS, Inc.; SmoothKote.

b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.

c. Rock Wool Manufacturing Company; Delta One Shot.

2.03 *Adhesives*

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aeroseal.

b. Armacell LCC; 520 Adhesive.

c. Foster Products Corporation, H. B. Fuller Company; 85-75.

d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.

b. Foster Products Corporation, H. B. Fuller Company; 85-20.

c. ITW TACC, Division of Illinois Tool Works; S-90/80.

d. Marathon Industries, Inc.; 225.

e. Mon-Eco Industries, Inc.; 22-25.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); 739, Dow Silicone.

b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.

c. P.I.C. Plastics, Inc.; Welding Adhesive.

d. Red Devil, Inc.; Celulon Ultra Clear.

e. Speedline Corporation; Speedline Vinyl Adhesive.

2.04 *Lagging Adhesives*

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-52.

b. Foster Products Corporation, H. B. Fuller Company; 81-42.

c. Marathon Industries, Inc.; 130.

d. Mon-Eco Industries, Inc.; 11-30.

e. Vimasco Corporation; 136.

2. Fire-resistant, water based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.

3. Service Temperature Range: Minus 50° to plus 180°F.

4. Color: White.*Sealants*

B. Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76-8.

b. Foster Products Corporation, H. B. Fuller Company; 95-44.

c. Marathon Industries, Inc.; 405.

d. Mon-Eco Industries, Inc.; 44-05.

e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40° to plus 250°F.

5. Color: Aluminum.

C. PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire and water resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40° to plus 250°F.

5. Color: White.

2.05 *Factory Applied Jackets*

A. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:

1. ASJ: White, Kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.

2. FSK Jacket: Aluminum foil, fiberglass-reinforced scrim with Kraft paper backing; complying with ASTM C 1136, Type II.

2.06 *Tapes*

A. ASJ Tape: White vapor-retarder tape matching factory applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.

b. Compac Corp.; 104 and 105.

c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.07 *Securements*

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products; Bands.

b. PABCO Metals Corporation; Bands.

c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon steel washer.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.

2) GEMCO; Cupped Head Weld Pin.

3) Midwest Fasteners, Inc.; Cupped Head.

4) Nelson Stud Welding; CHP.

2. Insulation Retaining Washers: Self-locking washers formed from 0.016-inch thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.

2) GEMCO; R-150.

3) Midwest Fasteners, Inc.; WA-150.

4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire

b. Childers Products

c. PABCO Metals Corporation

d. RPR Products, Inc.

2.08 *Corner Angles*

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 EXECUTION

3.01 *Examination*

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 *Preparation*

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.03 *General Installation Requirements*

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below ambient services, apply vapor barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration control devices
2. Testing agency labels and stamps
3. Nameplates and data plates
4. Manholes
5. Handholes
6. Cleanouts
7. Gas Piping

3.04 *Penetrations*

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.05 *Equipment, Tank, and Vessel Insulation Installation*

A. Mineral Fiber, Pipe, and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.

2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.

3. Protect exposed corners with secured corner angles.

4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

a. Do not weld anchor pins to ASME-labeled pressure vessels.

b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.

c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.

d. Do not over compress insulation during installation.

e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.

f. Impale insulation over anchor pins and attach speed washers.

g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless steel or aluminum bands. Select band material compatible with insulation materials.

6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch pre-stressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch pre-stressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.

8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.

9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

11. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.

12. Seal longitudinal seams and end joints.

B. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.

2. Fabricate boxes from aluminum, at least 0.050 inch thick.

3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.06 *General Pipe Insulation Installation*

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and

unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field applied jacket schedules, finish exposed surfaces with a metal jacket.

3.07 *Mineral Fiber Insulation Installation*

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor barrier mastic and joint sealant.

3. For insulation with factory applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.08 *Finishes*

A. Equipment and Pipe Insulation with Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.09 *Field Quality Control*

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect field insulated equipment, randomly selected by Architect, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 *Piping Insulation Schedule - General*

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.

3. Chrome plated pipes and fittings unless there is a potential for personnel injury.

3.11 *Indoor Piping Insulation Schedule*

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Storm water and Overflow:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Condensate and Equipment Drain Water below 60°F:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60°F:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 22 07 00

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 *Summary*

A. This Section includes domestic water piping inside the building.

B. Related Sections include the following:

1. Division 22 Section 22 11 19 "Domestic Water Piping Specialties" for water distribution piping specialties.

1.03 *Performance Requirements*

A. Provide components and installation capable of producing domestic water piping systems with 125 psig unless otherwise indicated.

1.04 *Submittals*

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Samples: Specified in Part 3 "Cleaning" Article.

C. Field quality control test reports.

1.05 *Quality Assurance*

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 PRODUCTS

2.01 *Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 *Piping Materials*

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.03 *Copper Tube and Fittings*

A. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.

1. Copper Pressure Seal Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, press seal-joint fittings. Furnish wrought-copper fittings if indicated. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder joint end

2. Copper Pressure Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.

4. Copper Unions: MSS SP-123, cast copper alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Seal Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, press seal-joint fittings. Furnish wrought-copper fittings if indicated. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder joint end.

2. Copper Pressure Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.

4. Copper Unions: MSS SP-123, cast copper alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.04 *Valves*

A. Bronze and cast iron, general duty valves are specified in Division 22 Section 22 05 23 "General-Duty Valves for Plumbing Piping."

B. Balancing and drain valves are specified in Division 22 Section 22 11 19 "Domestic Water Piping Specialties."

C. Valves shall be of the "LEAD FREE" design.

PART 3 EXECUTION

3.01 *Excavation*

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 *Pipe and Fitting Applications*

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Domestic Water Piping on Service Side of Water Meter inside the Building: Use the following piping materials for each size range:

1. NPS 4 (DN 100) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

E. Under Building Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 (DN 100) and Smaller: Soft copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

F. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

1. NPS 4 (DN 100) and Smaller: Hard copper tube, Type L (Type B); copper pressure seal joint fittings or copper pressure fittings and soldered joints.

3.03 *Valve Applications*

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

3. Hot Water Piping, Balancing Duty: Calibrated or memory stop balancing valves.

4. Drain Duty: Hose end drain valves.

B. Cast iron, grooved end valves may be used with grooved-end piping.

C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose end drain valves at low points in water mains, risers, and branches.

2. Install stop and waste drain valves where indicated.

E. Valves shall be of the "LEAD FREE" design.

3.04 *Piping Installation*

A. Basic piping installation requirements are specified in Division 22 Section 22 05 00 "General Provisions and Common Work Results for Plumbing."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install cast iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section 22 05 00 "General Provisions and Common Work Results for Plumbing."

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section 22 05 00 "General Provisions and Common Work Results for Plumbing."

E. Install water pressure regulators downstream from shutoff valves. Water pressure regulators are specified in Division 22 Section 22 11 19 "Domestic Water Piping Specialties."

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

G. Install ductile-iron, water service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion protection encasement according to ASTM A 674 or AWWA C105.

3.05 *Joint Construction*

A. Basic piping joint construction requirements are specified in Division 22 Section 22 05 00 "General Provisions and Common Work Results for Plumbing."

B. Pressure Sealed Joints for Copper Tubing: Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.06 *Hanger and Support Installation*

A. Pipe hanger and support devices are specified in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 feet and less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer than 100 feet: MSS Type 43, adjustable roller hangers.

c. Longer than 100 feet: MSS Type 49, spring cushion rolls, if indicated.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double rod hangers, to a minimum of 3/8 inch.

E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches with 3/8-inch rod.

2. NPS 1-1/2 (DN 40): 108 inches with 3/8-inch rod.
3. NPS 2 (DN 50): 10 feet with 3/8-inch rod.
4. NPS 2-1/2 (DN 65): 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet with 5/8-inch rod.
7. NPS 6 (DN 150): 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet with 7/8-inch rod.

F. Install supports for vertical steel piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches with 3/8-inch rod.
4. NPS 2-1/2 (DN 65): 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet with 1/2-inch rod.
6. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
7. NPS 8 (DN 200): 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

3.07 *Connections*

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water service piping with shutoff valve, and extend and connect to the following:

1. Water Heaters: Cold water supply and hot water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

2. Plumbing Fixtures: Cold and hot water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section 22 40 00 "Plumbing Fixtures."

3. Equipment: Cold and hot water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.08 *Field Quality Control*

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.09 *Adjusting*

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot water-circulation return piping to provide flow of hot water in each branch.

b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 *Cleaning*

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 11 16

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 *Summary*

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers
2. Backflow preventers
3. Water pressure reducing valves
4. Balancing valves
5. Temperature actuated water mixing valves
6. Strainers
7. Hose bibbs
8. Drain valves
9. Water hammer arresters
10. Air vents
11. Trap seal primer valves

B. Products furnished for this project shall be "LEAD FREE" as required by Federal legislation passed on January 4, 2011. This entails the wetted surfaces of plumbing fixtures, equipment, valves, etc. described in this section to have a weighted-average lead content of no more than 0.25% when used in applications intended to convey or dispense water for human consumption through drinking or cooking.

1.03 *Performance Requirements*

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

1.04 *Submittals*

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency operation and maintenance manuals.

1.05 *Quality Assurance*

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.

2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 PRODUCTS

2.01 *Vacuum Breakers*

A. Pipe Applied, Atmospheric Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Company

b. Conbraco Industries, Inc.

c. Watts Industries, Inc.; Water Products Division

d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1001.

3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.

4. Body: Bronze.

5. Inlet and Outlet Connections: Threaded.

6. Finish: Chrome plated.

B. Hose Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Conbraco Industries, Inc.
    b. Legend Valve
    c. Watts Industries, Inc.; Water Products Division
    d. Woodford Manufacturing Company
    e. Zurn Plumbing Products Group; Light Commercial Operation
    f. Zurn Plumbing Products Group; Wilkins Division
2. Standard: ASSE 1011.
3. Body: Bronze, non-removable, with manual drain.
4. Outlet Connection: Garden hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel-plated.

C. Pressure Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ames Company
    b. Conbraco Industries, Inc.
    c. Watts Industries, Inc.; Water Products Division
    d. Zurn Plumbing Products Group; Wilkins Division
2. Standard: ASSE 1020.
3. Operation: Continuous pressure applications.
4. Accessories:
    a. Valves: Ball type, on inlet and outlet.

D. Spill Resistant Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Division

2. Standard: ASSE 1056.

3. Operation: Continuous pressure applications.

4. Size: NPS 3/4 (DN 20).

5. Accessories:

   a. Valves: Ball type, on inlet and outlet.

2.02 *Backflow Preventers*

A. Intermediate Atmospheric Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.

   b. Legend Valve.

   c. Watts Industries, Inc.; Water Products Division

   d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1012.

3. Product shall be of the "LEAD FREE" design.

4. Operation: Continuous pressure applications.

5. Size: NPS 1/2 (DN 15) or NPS 3/4 (DN 20).

6. Body: Bronze.

7. End Connections: Union, solder joint.

8. Finish: Chrome plated.

B. Reduced Pressure Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ames Company

   b. Conbraco Industries, Inc.

   c. Watts Industries, Inc.; Water Products Division

   d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1013.

3. Product shall be of the "LEAD FREE" design.

4. Operation: Continuous pressure applications.

5. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

6. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.

7. End Connections: Threaded for NPS 2 (DN 50) and smaller flanged for NPS 2-1/2 (DN 65) and larger.

8. Configuration: Designed for horizontal, straight through flow.

9. Accessories:

   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

   b. Air Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double Check Backflow Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ames Company

   b. Conbraco Industries, Inc.

   c. Watts Industries, Inc.; Water Products Division

   d. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1015.

3. Product shall be of the "LEAD FREE" design.

4. Operation: Continuous pressure applications, unless otherwise indicated.

5. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

6. Body: Bronze for NPS 2 (DN 50) and smaller**;** cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.

7. End Connections: Threaded for NPS 2 (DN 50) and smaller flanged for NPS 2-1/2 (DN 65) and larger.

8. Configuration: Designed for horizontal, straight through flow.

9. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

D. Beverage Dispensing Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.

    b. Watts Industries, Inc.; Water Products Division

    c. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1022.

3. Product shall be of the "LEAD FREE" design.

4. Operation: Continuous-pressure applications.

5. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).

6. Body: Stainless steel.

7. End Connections: Threaded.

E. Dual Check Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.

    b. Legend Valve.

    c. Mueller Co.; Water Products Division

    d. Watts Industries, Inc.; Water Products Division

    e. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1024.

3. Product shall be of the "LEAD FREE" design.

4. Operation: Continuous-pressure applications.

5. Size: NPS 1/2 (DN 15) thru NPS 1-1/4 (DN 32).

6. Body: Bronze with union inlet.

F. Carbonated Beverage Dispenser, Dual Check Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Watts Industries, Inc.; Water Products Division

2. Standard: ASSE 1032.

3. Product shall be of the "LEAD FREE" design.

4. Operation: Continuous-pressure applications.

5. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).

6. Body: Stainless steel.

7. End Connections: Threaded.

G. Hose Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.

   b. Watts Industries, Inc.; Water Products Division

   c. Woodford Manufacturing Company.

2. Standard: ASSE 1052.

3. Product shall be of the "LEAD FREE" design.

4. Operation: Up to 10-foot head of water back pressure.

5. Inlet Size: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).

6. Outlet Size: Garden hose thread complying with ASME B1.20.7.

7. Capacity: At least 3-gpm flow.

H. Backflow Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.

b. Watts Industries, Inc.; Water Products Division

c. Zurn Plumbing Products Group; Wilkins Division

2. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with test-procedure instructions.

2.03 *Water Pressure Reducing Valves*

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.

b. Watts Industries, Inc.; Water Products Division

c. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1003.

3. Product shall be of the "LEAD FREE" design.

4. Pressure Rating: Initial working pressure of 150 psig.

5. Design Inlet Pressure: 100 psig.

6. Design Outlet Pressure Setting: 60 psig.

7. Body: Bronze with chrome plated finish for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

8. Valves for Booster Heater Water Supply: Include integral bypass.

9. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

2.04 *Balancing Valves*

A. Copper Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.

b. Flo Fab Inc.

c. ITT Industries; Bell & Gossett Division

d. Nibco Inc.

e. TAC Americas

f. Taco, Inc.

g. Watts Industries, Inc.; Water Products Division

2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.

3. Product shall be of the "LEAD FREE" design.

4. Body: Brass or bronze,

5. Size: Same as connected piping, but not larger than NPS 2 (DN 50).

6. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.

b. Flo Fab Inc.

c. ITT Industries; Bell & Gossett Division

d. Nibco Inc.

e. TAC Americas

f. Watts Industries, Inc.; Water Products Division

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.

3. Product shall be of the "LEAD FREE" design.

4. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Conbraco Industries, Inc.
    b. Crane Co.; Crane Valve Group; Stockham Division
    c. Hammond Valve
    d. Milwaukee Valve Company
    e. Nibco Inc.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Product shall be of the "LEAD FREE" design.
4. Pressure Rating: 400-psig minimum CWP.
5. Size: NPS 2 (DN 50) or smaller.
6. Body: Copper alloy.
7. Port: Standard or full port.
8. Ball: Chrome plated brass.
9. Seats and Seals: Replaceable.
10. End Connections: Solder joint or threaded.
11. Handle: Vinyl covered steel with memory setting device.

2.05 *Temperature Actuated Water Mixing Valves*

A. Primary Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Holby Valve Co., Inc.
2. Standard: ASSE 1017, thermostatically controlled tempering valve, listed as tempering valve.
3. Product shall be of the "LEAD FREE" design.
4. Pressure Rating: 125 psig minimum, unless otherwise indicated.
5. Body: bronze.

6. Temperature control: manual.

7. Inlets and outlet: threaded.

8. Tempered water setting: 130°F.

9. Valve Finish: Rough bronze.

B. Individual Fixture, Water Tempering Valves (To be provided under all lavatories and sinks):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.

b. Lawler Manufacturing Company, Inc.

c. Leonard Valve Company

d. Powers; a Watts Industries Company

e. Watts Industries, Inc.; Water Products Division

f. Zurn Plumbing Products Group; Wilkins Division

2. Standard: ASSE 1070, thermostatically controlled water tempering valve.

3. Product shall be of the "LEAD FREE" design.

4. Pressure Rating: 125 psig minimum, unless otherwise indicated.

5. Body: Brass body with corrosion-resistant interior components.

6. Temperature Control: Adjustable.

7. Inlets and Outlet: Threaded.

8. Finish: Rough or chrome plated bronze.

9. Model 7-210-CK "Maxline" manufactured by Symmons.

2.06 *Strainers for Domestic Water Piping*

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.

2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.

3. Product shall be of the "LEAD FREE" design.

4. End Connections: Threaded for NPS 2 (DN 50) and smaller flanged for NPS 2-1/2 (DN 65) and larger.

5. Screen: Stainless steel with round perforations, unless otherwise indicated.

6. Drain: Factory installed, hose end drain valve.

2.07 *Hose Bibbs*

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.

2. Body Material: Bronze.

3. Seat: Bronze, replaceable.

4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.

5. Outlet Connection: Garden hose thread complying with ASME B1.20.7.

6. Pressure Rating: 125 psig.

7. Vacuum Breaker: Integral**,** non-removable, drainable, hose connection vacuum breaker complying with ASSE 1011.

8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.

9. Finish for Service Areas: Chrome or nickel plated.

10. Finish for Finished Rooms: Chrome or nickel plated.

11. Operation for Equipment Rooms: Wheel handle or operating key.

12. Operation for Service Areas: Wheel handle.

13. Operation for Finished Rooms: Operating key.

14. Include operating key with each operating-key hose bibb.

15. Include integral wall flange with each chrome or nickel plated hose bibb.

2.08 *Drain Valves*

A. Ball Valve Type, Hose End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.

2. Pressure Rating: 400-psig minimum CWP.

3. Size: NPS 3/4 (DN 20).

4. Body: Copper alloy.

5. Ball: Chrome plated brass.

6. Seats and Seals: Replaceable.

7. Handle: Vinyl covered steel.

8. Inlet: Threaded or solder joint.

9. Outlet: Threaded, short nipple with garden hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate Valve Type, Hose End Drain Valves:

1. Standard: MSS SP-80 for gate valves.

2. Pressure Rating: Class 125.

3. Size: NPS 3/4 (DN 20).

4. Body: ASTM B 62 bronze.

5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.

6. Outlet: Garden hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.

2. Pressure Rating: 200-psig minimum CWP or Class 125.

3. Size: NPS 3/4 (DN 20).

4. Body: Copper alloy or ASTM B 62 bronze.

5. Drain: NPS 1/8 (DN 6) side outlet with cap.

2.09 *Water Hammer Arresters*

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMTROL, Inc.

b. Josam Company

c. PPP Inc.

d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

e. Tyler Pipe; Wade Division

f. Watts Drainage Products Inc.

g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.

3. Type: Copper tube with piston.

4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.10 *Air Vents*

A. Bolted Construction Automatic Air Vents:

1. Body: Bronze.

2. Pressure Rating: 125-psig minimum pressure rating at 140°F.

3. Float: Replaceable, corrosion-resistant metal.

4. Mechanism and Seat: Stainless steel.

5. Size: NPS 3/8 (DN 10) minimum inlet.

6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded Construction Automatic Air Vents:

1. Body: Stainless steel.

2. Pressure Rating: 150-psig minimum pressure rating.

3. Float: Replaceable, corrosion-resistant metal.

4. Mechanism and Seat: Stainless steel.

5. Size: NPS 3/8 (DN 10) minimum inlet.

6. Inlet and Vent Outlet End Connections: Threaded.

2.11 *Trap Seal Primer Valves*

A. Supply Type, Trap Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. PPP Inc.

b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

c. Watts Industries, Inc.; Water Products Division

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig minimum.

4. Body: Bronze.

5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 EXECUTION

3.01 *Installation*

A. Refer to Division 22 Section 22 05 00 "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric vent drain connection with air gap fitting, fixed air gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.

2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

G. Install water hammer arresters in water piping according to PDI-WH 201.

H. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

I. Install supply type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.02 *Connections*

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."

3.03 *Field Quality Control*

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker, reduced pressure principle backflow preventer, double check backflow prevention assembly, and double check, detector assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.04 *Adjusting*

A. Set field adjustable pressure set points of water pressure-reducing valves.

B. Set field adjustable flow set points of balancing valves.

C. Set field adjustable temperature set points of thermostatic water mixing valves.

END OF SECTION 22 11 19

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 *Summary*

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.

2. Special pipe fittings.

3. Encasement for underground metal piping.

1.03 *Definitions*

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.04 *Performance Requirements*

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.05 *Submittals*

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field quality control inspection and test reports.

1.06 *Quality Assurance*

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

C. Cast Iron soil pipe and fittings shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.

PART 2 PRODUCTS

2.01 *Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 *Piping Materials*

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 *Hub-And-Spigot, Cast Iron Soil Pipe and Fittings*

A. Pipe and Fittings: ASTM A 74, Service class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.04 *Hubless Cast Iron Soil Pipe and Fittings*

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy Duty, Shielded, Stainless steel Couplings: Heavy Duty Couplings shall conform to CISPI 310 and ASTM C 1277. Shield Assemblies shall consist of a stainless steel bi-directional corrugated shield; stainless-steel bands and tightening devices; and a ASTM C 564, rubber sleeve with integral center stop. Couplings shall bear the NSF Trademark, and be manufactured in the USA.

2. Manufacturers:

    a. Clamp-All Corporation

    b. Husky

    c. Mission Rubber Company

        1) Tyler Pipe; Soil Pipe Division

2.05 *Steel Pipe and Fittings*

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Pressure Fittings:

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.

2. Malleable iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

3. Gray iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

4. Cast iron Flanges: ASME B16.1, Class 125.

5. Cast iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

C. Grooved Joint Systems

1. Manufacturers:

    a. Anvil International

    b. Star Pipe Products; Star Fittings Division

    c. Victaulic Company

    d. Ward Manufacturing, Inc.

2. Grooved End, Steel piping Fittings: ASTM A 47/A 47M, galvanized, malleable iron casting; ASTM A 106, galvanized steel pipe; or ASTM A 536, galvanized, ductile iron casting; with dimensions matching steel pipe.

3. Grooved end, steel piping couplings: AWWA C606, for steel pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.06 *Ductile Iron Pipe and Fittings*

A. Mechanical Joint, Ductile iron Pipe: AWWA C151, with mechanical joint bell and plain spigot end, unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile iron Fittings: AWWA C110, ductile- or gray iron standard pattern or AWWA C153, ductile iron compact pattern.

2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile iron Fittings: AWWA C110, ductile- or gray iron standard pattern or AWWA C153, ductile iron compact pattern.

2. Gaskets: AWWA C111, rubber.

C. Grooved joint Systems:

1. Manufacturers:

a. Victaulic Company

2. Grooved end, ductile iron Fittings: ASTM A 47/A 47M, malleable iron castings or ASTM A 536, ductile iron castings with dimensions matching pipe.

3. Grooved end, ductile iron Piping Couplings: AWWA C606, for ductile iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.07 *Copper Tube and Fittings*

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

2.08 PVC PIPE AND FITTINGS (NOT PERMITTED IN PLENUM RATED AREAS)

A. Solid Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.09 *Special Pipe Fittings*

A. Flexible, Non-pressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion resistant metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Dallas Specialty & Mfg. Company

b. Fernco, Inc.

c. Logan Clay Products Company (The)

d. Mission Rubber Company

e. NDS, Inc.

2. Sleeve Materials:

a. For Cast iron Soil Pipes: ASTM C 564, rubber.

b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Non-pressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Company

b. Mission Rubber Company

C. Rigid, Unshielded, Non-pressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. ANACO

D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Company

b. Dresser, Inc.; DMD Division

c. EBAA Iron Sales, Inc.

d. Ford Meter Box Company, Inc. (The); Pipe Products Division

e. JCM Industries, Inc.

f. Romac Industries, Inc.

g. Smith-Blair, Inc.

h. Viking Johnson

2. Center-Sleeve Material: Manufacturer's standard.

3. Gasket Material: Natural or synthetic rubber.

4. Metal Component Finish: Corrosion-resistant coating or material.

E. Flexible Ball Joints: Ductile iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile iron gland, rubber gasket, and steel bolts.

1. Manufacturers:

a. EBAA Iron Sales, Inc.

F. Expansion Joints: Two or three-piece, ductile iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

a. EBAA Iron Sales, Inc.

b. Romac Industries, Inc.

c. Star Pipe Products; Star Fittings Division

G. Wall Penetration Fittings: Compound, ductile iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

a. SIGMA Corporation

2.10 *Encasement for Underground Metal Piping*

A. Description: ASTM A 674 or AWWA C105, high-density, cross-laminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.

B. Form: Sheet or tube.

C. Color: Black or natural.

PART 3 EXECUTION

3.01 *Excavation*

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.02 *Piping Applications*

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be the following:

1. Hubless cast iron soil pipe and fittings; heavy-duty shielded, stainless steel couplings; and hubless coupling joints.

2. Copper DWV tube, copper drainage fittings, and soldered joints.

3. Dissimilar Pipe Material Couplings: Shielded, Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:

1. Hubless cast iron soil pipe and fittings; heavy-duty shielded, stainless steel couplings; and hubless coupling joints.

2. Dissimilar Pipe-Material Couplings: Shielded, Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Hubless cast iron soil pipe and fittings; heavy-duty shielded, stainless steel couplings; and hubless coupling joints.

2. Copper DWV tube, copper drainage fittings, and soldered joints.

3. Dissimilar Pipe-Material Couplings: Shielded, Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be the following:

1. Hubless cast iron soil pipe and fittings; heavy-duty shielded, stainless steel couplings; and hubless coupling joints.

2. Dissimilar Pipe Material Couplings: Shielded, Non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

F. Underground buried within 5' of the building, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Service class, cast iron soil piping; gaskets; and gasketed joints.

2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

G. Underground buried within 5' of the building, soil and waste piping NPS 5 (DN 125) and larger shall be the following:

1. Service class, cast iron soil piping; gaskets; and gasketed joints.

2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.

3.03 *Piping Installation*

A. Basic piping installation requirements are specified in Division 22 Section 22 05 00 "General Provisions and Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

D. Install underground, ductile iron, special pipe fittings according to AWWA C600.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

E. Install cast iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section 22 05 00 "General Provisions and Common Work Results for Plumbing."

F. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

G. Install cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use

long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drainpipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: Two percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.

2. Horizontal Sanitary Drainage Piping (2-1/2" and less): Two percent downward in direction of flow.

3. Horizontal Sanitary Drainage Piping (3" and larger): One percent downward in direction of flow.

4. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Sleeves are not required for cast iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.04 *Joint Construction*

A. Basic piping joint construction requirements are specified in Division 22 Section 22 05 00 "General Provisions and Common Work Results for Plumbing."

B. Join hub-and-spigot, cast iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hubless cast iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless coupling joints.

D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

E. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

F. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

3.05 *Valve Installation*

A. General valve installation requirements are specified in Division 22 Section 22 05 23 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.

2. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves.

2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.

3. Install backwater valves in accessible locations.

4. Backwater valve are specified in Division 22 Section 221319 "Sanitary Waste Piping Specialties."

3.06 *Hanger and Support Installation*

A. Pipe hangers and supports are specified in Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.

2. Install individual, straight, horizontal piping runs according to the following:

a. 100 feet and less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer than 100 feet: MSS Type 43, adjustable roller hangers.

c. Longer than 100 feet if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches with 3/8-inch rod.

2. NPS 3 (DN 80): 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches with 5/8-inch rod.

4. NPS 6 (DN 150): 60 inches with 3/4-inch rod.

5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches with 7/8-inch rod.

F. Install supports for vertical cast iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches with 3/8-inch rod.

2. NPS 1-1/2 (DN 40): 108 inches with 3/8-inch rod.

3. NPS 2 (DN 50): 10 feet with 3/8-inch rod.

4. NPS 2-1/2 (DN 65): 11 feet with 1/2-inch rod.

5. NPS 3 (DN 80): 12 feet with 1/2-inch rod.

6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet with 5/8-inch rod.

7. NPS 6 (DN 150): 12 feet with 3/4-inch rod.

8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches with 3/8-inch rod.

2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches with 3/8-inch rod.

3. NPS 2-1/2 (DN 65): 108 inches with 1/2-inch rod.

4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet with 1/2-inch rod.

5. NPS 6 (DN 150): 10 feet with 5/8-inch rod.

6. NPS 8 (DN 200): 10 feet with 3/4-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.07 *Connections*

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.08 *Field Quality Control*

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.09 *Cleaning*

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 *Protection*

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 *Summary*

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts
2. Floor drains
3. Roof flashing assemblies
4. Through penetration firestop assemblies
5. Miscellaneous sanitary drainage piping specialties
6. Flashing materials
7. Safe waste drains
8. Fresh Air Inlets

1.03 *Definitions*

A. ABS: Acrylonitrile-butadiene-styrene plastic

B. FOG: Fats, oils, and greases

C. FRP: Fiberglass reinforced plastic

D. HDPE: High-density polyethylene plastic

E. PE: Polyethylene plastic

F. PP: Polypropylene plastic

G. PVC: Polyvinyl chloride plastic

1.04 *Submittals*

A. Shop Drawings: Show fabrication and installation details for frost resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

B. Field quality control test reports.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.05 *Quality Assurance*

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.06 *Coordination*

A. Coordinate size and location of concrete bases. Cast anchor bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 PRODUCTS

2.01 *Cleanouts*

A. Exposed Metal Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Division

b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

c. Tyler Pipe; Wade Division

d. Watts Drainage Products Inc.

e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

3. Size: Same as connected drainage piping

4. Body Material: Hubless, cast iron soil pipe test tee as required to match connected piping.

5. Closure: plastic plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Closure: Stainless steel plug with seal.

B. Exposed Exterior Surfaced Area Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Division

   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

   c. Tyler Pipe; Wade Division

   d. Watts Drainage Products Inc.

   e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

3. Size: Same as connected drainage piping

4. Body Material: Hubless, cast iron soil pipe test tee as required to match connected piping.

5. Closure: cast iron plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Closure: Stainless steel plug with seal.

8. Model: ZN-1400-HD manufactured by Zurn.

C. Exposed Exterior Un-surfaced Area Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Division

   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

   c. Tyler Pipe; Wade Division

   d. Watts Drainage Products Inc.

   e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

3. Size: Same as connected drainage piping

4. Body Material: Hubless, cast iron soil pipe test tee as required to match connected piping.

5. Closure: cast iron plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Closure: Stainless steel plug with seal.

8. Model: Z-1474 manufactured by Zurn.

D. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Division

   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

   c. Tyler Pipe; Wade Division

   d. Watts Drainage Products Inc.

   e. Zurn Plumbing Products Group; Light Commercial Operation.

   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.

3. Size: Same as connected branch.

4. Type: Adjustable housing.

5. Body or Ferrule: Cast iron.

6. Clamping Device: Required.

7. Outlet Connection: Inside calk.

8. Closure: Plastic plug.

9. Adjustable Housing Material: Cast iron.

10. Frame and Cover Material and Finish: Polished nickel bronze.

11. Frame and Cover Shape: Round.

12. Top Loading Classification: Medium Duty.

13. Riser: ASTM A 74, Service class, cast iron drainage pipe fitting and riser to clean out.

14. Standard: ASME A112.3.1.

15. Size: Same as connected branch.

16. Housing: Stainless steel.

17. Closure: Stainless steel with seal.

18. Riser: Stainless steel drainage pipe fitting to clean out.

19. Model: ZN-1400 manufactured by Zurn.

E. Cast Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Division

b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

c. Tyler Pipe; Wade Division

d. Watts Drainage Products Inc.

e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.

4. Body: Hubless, cast iron soil pipe test tee as required to match connected piping.

5. Closure: drilled-and-threaded plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Wall Access: Round, flat, chrome plated brass or stainless steel cover plate with screw.

8. Wall Access: Round stainless steel wall installation frame and cover.

2.02 *Floor Drains*

A. Cast Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Division

b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

c. Tyler Pipe; Wade Division

d. Watts Drainage Products Inc.

e. Zurn Plumbing Products Group; Light Commercial Operation.

f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Floor Drain (FD-1):

a. Standard: ASME A112.6.3.

b. Pattern: Floor drain.

c. Body Material: Gray iron.

d. Seepage Flange: Required.

e. Anchor Flange: Required.

f. Clamping Device: Required.

g. Outlet: Bottom.

h. Backwater Valve: Not required.

i. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.

j. Sediment Bucket: Required.

k. Top or Strainer Material: Nickel bronze.

l. Top of Body and Strainer Finish: Durra-Coated Cast Iron.

m. Top Shape: Round.

n. Top Loading Classification: Medium Duty.

o. Funnel: Not required.

p. Trap Material: Cast iron.

q. Trap Pattern: Standard P-trap.

r. Trap Features: Trap-seal primer valve drain connection, where required.

s. Model: ZN-415-6-B-Y manufactured by Zurn.

3. Floor Drain (FD-2):

    a. Standard: ASME A112.6.3.

    b. Pattern: Floor drain.

    c. Body Material: Gray iron.

    d. Seepage Flange: Required.

    e. Anchor Flange: Required.

    f. Clamping Device: Required.

    g. Outlet: Bottom.

    h. Backwater Valve: Not required.

    i. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.

    j. Sediment Bucket: Required.

    k. Top or Strainer Material: Nickel bronze with raised lip set flush with floor.

    l. Top of Body and Strainer Finish: Durra-Coated Cast Iron.

    m. Top Shape: Round.

    n. Top Loading Classification: Medium Duty.

    o. Funnel: Not required.

    p. Trap Material: Cast iron.

    q. Trap Pattern: Standard P-trap.

    r. Trap Features: Trap-seal primer valve drain connection, where required.

    s. Model: ZN-415-7I-Y manufactured by Zurn.

4. Floor Drain (FD-3):

    a. Same as FD-1 with vandal-proof secure top.

2.03 *Roof Flashing Assemblies*

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company; Elmdor/Stoneman Division

b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch thick, flashing collar and skirt extending at least 8 inches from pipe, with galvanized steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.

2. Low-Silhouette Vent Cap: With vandal proof vent cap.

3. Extended Vent Cap: With field installed, vandal proof vent cap.

2.04 *Through Penetration Firestop Assemblies*

A. Through penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.

3. Size: Same as connected soil, waste, or vent stack.

4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

5. Stack Fitting: ASTM A 48/A 48M, gray iron, hubless-pattern, wye branch with neoprene O-ring at base and gray iron plug in thermal-release harness. Include PVC protective cap for plug.

6. Special Coating: Corrosion resistant on interior of fittings.

2.05 *Miscellaneous Sanitary Drainage Piping Specialties*

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.

2. Size: Same as connected waste piping.

B. Deep Seal Traps:

1. Description: Cast iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

   a. NPS 2 (DN 50): 4-inch minimum water seal.

   b. NPS 2-1/2 (DN 65) and Larger: 5-inch minimum water seal.

C. Floor Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

D. Air Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.

4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast iron body with threaded or hub inlet and vandal proof design. Include vented hood and setscrews to secure to vent pipe.

2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper or galvanized steel.

2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints:

1. Standard: ASME A112.21.2M.

2. Body: Cast iron with bronze sleeve, packing, and gland.

3. End Connections: Matching connected piping.

4. Size: Same as connected soil, waste, or vent piping.

J. Safewaste Drains:

1. Description: Coated cast iron combination funnel and trap drain with cleanout plug.

2. Size: 4-inch diameter funnel top with dome strainer and 2-inch threaded outlet.

3. Model: Z-1019-DS manufactured by Zurn.

K. Vent Caps:

1. Description: FAI-1, wall type, round chrome plated nickel bronze, crowned and perforated, with 4 point locking device. Model: Z-1471-CP manufactured by Zurn.

2. Description: FAI-2, wall type, round chrome plated nickel bronze with securing cover, 4 inch pipe size, female threaded connection. Model: Z-1472-CP manufactured by Zurn.

2.06 *Flashing Materials*

A. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.

2. Vent Pipe Flashing: 8 oz./sq. ft.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 EXECUTION

3.01 *Installation*

A. Refer to Division 22 Section 22 05 00 "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 (DN 100) and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.

b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Install through penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

I. Assemble open drain fittings and install with top of hub 1 inch, 2 inches above floor.

J. Install deep-seal traps on floor drains and other waste outlets, if indicated.

K. Install floor drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

2. Size: Same as floor drain inlet.

L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N. Install vent caps on each vent pipe passing through roof.

O. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

P. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

Q. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

R. Install wood-blocking reinforcement for wall mounting type specialties.

S. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

T. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.02 *Connections*

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Division 26 Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."

3.03 *Flashing Installation*

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 *Field Quality Control*

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.05 *Protection*

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 *Summary*

A. This Section includes the following conventional plumbing fixtures and related components:

1. Water closets (Including toilet seats and fixture supports).

2. Lavatories (Including faucets, fixture supports, thermostatic mixing valves, and protective shielding guards).

3. Sinks (Including faucets, thermostatic mixing valves, and protective shielding guards).

B. Products furnished for this project shall be “LEAD FREE” as required by Federal legislation passed on January 4, 2011. This entails the wetted surfaces of plumbing fixtures, equipment, valves, etc. described in this section to have a weighted-average lead content of no more than 0.25% when used in applications intended to convey or dispense water for human consumption through drinking or cooking.

C. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."

2. Division 22 Section 22 11 19 "Domestic Water Piping Specialties" for backflow preventers and specialty fixtures not included in this Section.

1.03 *Definitions*

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat, impact, scratch, and stain resistance qualities.

1.04 *Submittals*

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.05 *Quality Assurance*

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast iron Fixtures: ASME A112.19.1M.

2. Plastic Mop Service Basins: ANSI Z124.6.
3. Porcelain Enameled, Formed Steel Fixtures: ASME A112.19.4M.
4. Solid Surface Material Lavatories and Sinks: ANSI/ICPA SS-1.
5. Stainless steel Commercial, Hand wash sinks: NSF 2 construction.
6. Vitreous China Fixtures: ASME A112.19.2M.
7. Water closet, Flush Valve, Tank Trim: ASME A112.19.5.
8. Water closet, Flushometer Tank Trim: ASSE 1037.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose connection Vacuum Breakers: ASSE 1011.
6. Hose coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Plastic Tubular Fittings: ASTM F 409.
4. Brass Waste Fittings: ASME A112.18.2.

5. Sensor Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.

2. Floor Drains: ASME A112.6.3.

3. Grab Bars: ASTM F 446.

4. Hose coupling Threads: ASME B1.20.7.

5. Off Floor Fixture Supports: ASME A112.6.1M.

6. Pipe Threads: ASME B1.20.1.

7. Plastic Toilet Seats: ANSI Z124.5.

8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.06 *Extra Materials*

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

3. Water Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.

4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.

5. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 PRODUCTS

2.01 *Manufacturers: Subject To Compliance With Requirements, Provide Products By The List Of Acceptable Manufacturers Listed Below:*

A. Acceptable Manufacturers - Vitreous China Fixtures

1. American Standard Company, Inc.

2. Kohler Company

3. Sloan Valve Company
4. Zurn Plumbing Products Group

B. Acceptable Manufacturers - Stainless Steel Sinks

1. Elkay Manufacturing Company
2. Just Manufacturing Company
3. Moen Commercial, Inc.

C. Acceptable Manufacturers - Fixture Trim

1. American Standard Company, Inc.
2. Chicago Faucet Company
3. McGuire Manufacturing Company

D. Acceptable Manufacturers - Electronic Fixture Trim

1. Sloan Valve Company
2. American Standard Company, Inc.
3. Chicago Faucet Company
4. Zurn Plumbing Products Group

E. Acceptable Manufacturers - Flush Valves

1. Sloan Valve Company
2. American Standard Company, Inc.
3. Zurn Plumbing Products Group

F. Acceptable Manufacturers - Water Closet Seats

1. Beneke, Sanderson Plumbing Products Inc.
2. Bemis Manufacturing Company
3. Centoco Manufacturing
4. Church, Bemis Manufacturing Company
5. Olsonite, Bemis Manufacturing Company

G. Acceptable Manufacturers - Fixture Carriers

1. Josam Company
2. Smith, Jay R. Manufacturing Company
3. Tyler Pipe; Wade Division
4. Watts Drainage Products Inc.
5. Zurn Plumbing Products Group

H. Acceptable Manufacturers - ASSE 1070 Thermostatic Valves

1. Symmons Industries, Inc.
2. Lawler Manufactuing Company, Inc.
3. Leonard Valve Company
4. Powers; a Watts Industries Company
5. Watts Industries, Inc.
6. Zurn Plumbing Products Group

2.02 *Water Closets*

A. Water Closet (WC-1) Standard Height, Floor Mounted, Tank Type:

1. Bowl: ANSI A112.19.2; floor mounted siphon jet, vitreous china, 15 inch high close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps with retainers, 1.6 gallons per flush; Model 270CA.001 "Cadet 3" manufactured by American Standard.

2. Trim: Chrome plated, convertible quarter-turn brass ball valve angle stops with 3/8 inch braided stainless steel risers and escutcheons; Model LFBV2165 manufactured by McGuire Manufacturing Company.

3. Seat: Solid white plastic, open front, extended back, self-sustaining check hinges, stainless steel posts, without cover; Model 95SSCT manufactured by Olsonite.

2.03 *Lavatories*

A. Lavatory (L-1) Standard Height, Countertop, Automatic Faucet & Trim Only:

1. Basin: Solid surface countertop with integral bowl provided by GC.

2. Trim (1.0 gpm - Battery): ANSI A112.18.1; Battery-powered, infrared sensor, chrome plated brass lavatory spout with solenoid operator, 1.0 gpm flow control, above deck

mixer, 4" trim plate and single supply for installation of a below deck mixing valve; Model Z6918-XL-L-ADM-CP4 "Aqua Sense" manufactured by Zurn. Heavy duty, chrome plated, cast brass grid strainer with 17 gauge tailpiece; Model 155A manufactured by McGuire Manufacturing Company. Chrome plated, convertible quarter-turn brass ball valve angle stops with 3/8 inch braided stainless steel risers and escutcheons; Model LFBV2165 manufactured by McGuire Manufacturing Company. Chrome plated, 17 gauge cast brass P-trap with cleanout plug and arm with escutcheon; Model 8902 manufactured by McGuire Manufacturing Company.

3. Thermostatic Mixing Valve: ASSE 1070 & 1017; brass body, brass and stainless steel internal components, dual stainless steel strainers and checks on inlet, temperature-response element, vandal resistant universal cap/temperature adjustment handle, lead free; Model 7-210-CK "Maxline" manufactured by Symmons.

2.04 *Sinks*

A. Sink (S-1) Standard Height, Drop-In, Single Bowl:

1. Bowl: ANSI A112.19.3; single compartment, countertop drop-in, 15 inch x 15 inch x 7-1/8 inch outside dimensions, 18 gauge, type 304 nickel bearing stainless steel, self-rimming with undercoating, 2 inch outlet, ledgeback with 3-hole drilling for faucet; Model BLR15 manufactured by Elkay Manufacturing Company.

2. Trim (1.5 gpm): ANSI A112.18.1; chrome plated brass supply with 11-5/8 inch high, 5-1/4 inch spread rigid/swing gooseneck spout, 2.2 gpm aerator, 2-3/8 inch level handles on 8 inch centers; Model 786-E3-369ABCP manufactured by Chicago Faucet Company. Type 304 stainless steel grid strainer and tailpiece; Model LK58 manufactured by Elkay. Chrome plated, convertible quarter-turn brass ball valve angle stops with 3/8 inch braided stainless steel risers and escutcheons; Model LFBV2165 manufactured by McGuire Manufacturing Company. Chrome plated, 17 gauge cast brass P-trap with cleanout plug and arm with escutcheon; Model 8912 manufactured by McGuire Manufacturing Company.

3. Thermostatic Mixing Valve: ASSE 1070 & 1017; brass body, brass and stainless steel internal components, dual stainless steel strainers and checks on inlet, temperature-response element, vandal resistant universal cap/temperature adjustment handle, lead free; Model 7-210-CK "Maxline" manufactured by Symmons.

PART 3 EXECUTION

3.01 *Examination*

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 *Installation*

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.

2. Use carrier supports without waste fitting for fixtures with tubular waste piping.

3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall mounting fixtures with tubular waste piping attached to supports.

F. Install floor mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. Install water supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section 22 05 23 "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install toilet seats on water closets.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section 22 05 00 "Common Work Results for Plumbing."

S. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section 22 05 00 "Common Work Results for Plumbing."

T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.03 *Connections*

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."

3.04 *Field Quality Control*

A. Refer to architectural drawings for exact plumbing fixture locations, mounting heights and dimensions.

B. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

C. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

D. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

E. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

F. Install fresh batteries in sensor-operated mechanisms.

3.05 *Adjusting*

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

D. Install fresh batteries in sensor-operated mechanisms.

3.06 *Cleaning*

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.07 *Protection*

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

ELECTRICAL INDEX

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SECTION 26 01 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

C. Division 09 FINISHES Sections.

1.02 *Summary*

A. This Section includes general administrative, procedural requirements, construction materials and construction methods for electrical installations. The following requirements are included in this Section to expand the requirements specified in Division 01 - reference individual sections for further expansion of these requirements:

1. Abbreviations and Acronyms
2. Definitions
3. Permits, Codes, and Inspections
4. Visiting Premises
5. Project Drawings and Specifications
6. Nameplate Data
7. Coordination
8. Substitutions
9. Submittals
10. Quality Assurance and Testing
11. Temporary
12. Delivery, Storage, and Handling
13. Cutting and Patching
14. Installations
15. Final Cleaning

16. Warranties

17. Maintenance Manuals

18. Record Documents

19. Demonstration and Training

1.03 *Abbreviations and Acronyms*

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AAMA - American Architectural Manufacturers Association; www.aamanet.org.

2. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.

3. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.

4. AIA - American Institute of Architects (The); www.aia.org.

5. AISC - American Institute of Steel Construction; www.aisc.org.

6. AISI - American Iron and Steel Institute; www.steel.org.

7. ANSI - American National Standards Institute; www.ansi.org.

8. APA - Architectural Precast Association; www.archprecast.org.

9. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.

10. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.

11. ASSE - American Society of Safety Engineers (The); www.asse.org.

12. ASTM - ASTM International; www.astm.org.

13. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.

14. AWEA - American Wind Energy Association; www.awea.org.

15. BICSI - BICSI, Inc.; www.bicsi.org.

16. CDA - Copper Development Association; www.copper.org.

17. CEA - Consumer Electronics Association; www.ce.org.
18. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
19. CSA - CSA Group; www.csa.ca.
20. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
21. CSI - Construction Specifications Institute (The); www.csinet.org.
22. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
23. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
24. DHI - Door and Hardware Institute; www.dhi.org.
25. DOE - Department of Energy; www.energy.gov.
26. ECA - Electronic Components Association; (See ECIA).
27. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
28. ECIA - Electronic Components Industry Association; www.eciaonline.org.
29. EIA - Electronic Industries Alliance; (See TIA).
30. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
31. EPA - Environmental Protection Agency; www.epa.gov.
32. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
33. ESTA - Entertainment Services and Technology Association; (See PLASA).
34. ETL - Intertek (See Intertek); www.intertek.com.
35. FM Approvals - FM Approvals LLC; www.fmglobal.com.
36. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
37. GSA - General Services Administration; www.gsa.gov.
38. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
39. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
40. ICBO - International Conference of Building Officials; (See ICC).
41. ICC - International Code Council; www.iccsafe.org.

42. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
43. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
44. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
45. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
46. IESNA - Illuminating Engineering Society of North America; (See IES).
47. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
48. ISO - International Organization for Standardization; www.iso.org.
49. ITU - International Telecommunication Union; www.itu.int/home.
50. MCA - Metal Construction Association; www.metalconstruction.org.
51. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
52. MHIA - Material Handling Industry of America; www.mhia.org.
53. MPI - Master Painters Institute; www.paintinfo.com.
54. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
55. NBI - New Buildings Institute; www.newbuildings.org.
56. NCMA - National Concrete Masonry Association; www.ncma.org.
57. NECA - National Electrical Contractors Association; www.necanet.org.
58. NEMA - National Electrical Manufacturers Association; www.nema.org.
59. NETA - InterNational Electrical Testing Association; www.netaworld.org.
60. NFHS - National Federation of State High School Associations; www.nfhs.org.
61. NFPA - National Fire Protection Association; www.nfpa.org.
62. NICET - National Institute for Certification in Engineering Technologies.
63. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
64. NSPE - National Society of Professional Engineers; www.nspe.org.
65. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.

66. OSHA - Occupational Safety & Health Administration; www.osha.gov.

67. PCI - Precast/Prestressed Concrete Institute; www.pci.org.

68. RoHS - Restriction of Hazardous Substances

69. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.

70. SIA - Security Industry Association; www.siaonline.org.

71. SPIB - Southern Pine Inspection Bureau; www.spib.org.

72. SSINA - Specialty Steel Industry of North America; www.ssina.com.

73. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.

74. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.

75. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).

76. UL - Underwriters Laboratories Inc.; www.ul.com.

77. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.

78. WASTEC - Waste Equipment Technology Association; www.wastec.org.

1.04 *Definitions*

A. Basic Contract definitions are included in the Conditions of the Contract.

1. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, 'approved' is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

2. Concealed: Embedded in masonry or other construction, installed behind wall furring or within double partitions or installed within hung ceilings.

3. Conduit: The inclusion of all fittings, hangers, supports, sleeves, etc.

4. Contractor: As stated herein shall mean Electrical Contractor.

5. Directed: A command or instruction by Architect. Other terms including 'requested,' 'authorized,' 'selected,' 'required,' and 'permitted' have the same meaning as 'directed.'

6. Equal: Equivalent as approved by the Architect or their representative.

7. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

8. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including 'shown,' 'noted,' 'scheduled,' and 'specified' have the same meaning as 'indicated.'

9. Install: Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

10. Project Site: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

11. Provide: Furnish and install, complete and ready for the intended use.

12. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

13. Wiring: The inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such work.

1.05 *Permits, Codes, and Inspections*

A. Contractor shall obtain and pay for all permits and inspections required by laws, ordinances, rules, and regulations having jurisdiction for work included under this Contract, and shall submit approval certificates to the Architect.

B. The electrical installation shall comply fully with

1. All local, county and state laws, ordinances and regulations having jurisdiction and as applicable to the electrical installations.

2. All approved published instructions set forth by equipment manufacturers.

C. The Electrical installation and all components shall be in compliance with the code and/or standard requirements of the latest revision or state-adopted edition of:

1. American Society for Testing and Materials (ASTM)

2. Americans with Disabilities Act (ADA)

3. Building Communication International (BISCI)

4. FM Global (Factory Mutual) Approval Guide

5. Institution of Electrical and Electronic Engineers (IEEE)
6. International Building Code (IBC)
7. International Fire Code (IFC)
8. International Energy Conservation Code (IECC)
9. Legislative Act 235 (1965) - Handicapped
10. Legislative Act 287 (1974) - Excavation
11. National Electric Code (NEC)
12. National Electrical Contractor's Association (NECA)
13. National Electrical Manufacturer's Association (NEMA)
14. National Electrical Safety Code (NESC)
15. National Fire Protection Association (NFPA)
16. National Safety Code
17. Occupational Safety and Health Act (OSHA)
18. Telecommunications Industry Association/Electronic Industries Association (TIA/EIA)
19. Underwriter's Laboratories, Inc. (UL)

D. Submit certificates issued by approved authorized agencies to indicate conformance of all work with the above requirements, as well as any additional certificates as may be required for the performance of this contract work.

E. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architect prior to execution of the work. The work shall be carried out according to the requirements of such code in accordance with the instruction of the Architect and at no additional cost to the Owner.

F. Certificate of Inspection: The Contractor shall procure and pay for the Certificate of Inspection from the municipality-approved inspection agency and deliver it to the Architect before final payment is made.

1.06 *Visiting Premises*

A. The Bidder shall visit the project site before submitting his bid, in order to familiarize themself with existing conditions that may affect his work. It is the Contractor's responsibility to analyze existing conditions. Sufficient allowances shall be provided in the

Contractor's bid to cover work, due to existing conditions, that will be required to complete this contract work.

B. By submission of a bid, the Contractor is attesting that responsible personnel did in fact visit the site during the bidding period and verified all existing pertinent conditions.

C. Contractor shall verify all measurements and dimensions at the site prior to submitting a bid.

1.07 *Project Drawings and Specifications*

A. Contractor shall carefully examine the Drawings and Specifications of all trades and report all discrepancies to the Architect in writing to obtain corrective action. No departures from the Contract Documents will be made without prior written approval from the Architect.

B. Questions or disputes regarding the intent or meaning of Contract Documents shall be resolved by the interpretation of the Architect. The Architect's interpretation is final and binding.

C. The Drawings and Specifications are not intended to define all details, finish materials, and special construction that may be required or necessary. The Contractor shall provide all installations complete and adequate as implied by the project documents.

D. Drawings are diagrammatic only and do not show exact routes and locations of equipment and associated wiring. The Contractor shall verify the work of all other trades and shall arrange his work to avoid conflicts. In the event of a conflict, the Contractor shall obtain corrective action from the Architect.

E. All work shall be considered new, unless noted otherwise.

F. Prior to the submitting of bids, the Contractor shall familiarize himself with all conditions affecting the proposed installation of equipment by all trades that will require electrical connections and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final electrical connections and equipment.

1.08 *Contractor Qualifications (Network Cabling)*

A. The apparent low bidder shall demonstrate their qualifications by providing the following documents for the local area network cabling:

1. A listing of the LAST five (5) Local Area Network (LAN) systems that were installed by the bidder:

a. The listing shall include only LANs that included the installation of fiber optic cable, unshielded twisted pair (UTP) cable, and Gigabit Ethernet equipment.

b. The listing shall be for the last five projects, regardless of size or location, which are operational and have been turned over to the Owner.

c. The listing shall include a brief description of the project, type of LAN, size of the system, Owner's name and address and representative, date started, and date of completion.

d. The listing shall include a letter from the Owner of each of the 5 projects. The letter shall be on the Owner's letterhead and shall be signed by an officer or authorized agent of the Owner. The letter shall state the overall satisfaction or dissatisfaction with the performance of the Contractor, and the quality of workmanship in regards to installation of the cabling, hardware, and software.

2. The bidder shall furnish a list of the names of all full-time employees that the Contractor plans to use on the project.

a. The listing shall include each person's title, length of current employment with the company, training, and certification.

b. The listing shall also include a resume for the Project Manager.

c. The listing shall also include registration number and a copy of the current BICSI certificate for each RCDD.

B. All bidders shall be certified and registered by the applicable cable/connector manufacturer and submit certifications of training in the installation and maintenance of the specified systems.

C. The bidder shall furnish a list of all test equipment that will be used in the installation and testing of the fiber optics cable and the twisted pair cable.

D. All of the above documents shall be submitted within 48 hours (excluding weekends and holidays) following the Bid due date/time.

PART 2 PRODUCTS

2.01 *General*

A. All materials and equipment for which Underwriter's Laboratories have established standards shall bear a UL label of approval.

B. When two or more items of same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, and similar items used in work, except as otherwise indicated.

C. Provide products that are compatible within systems and other connected items.

D. In all cases where a device, function or item of equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation.

E. All listed materials and equipment shown on drawings and/or specified herein, are indicative of complete and whole units and shall be furnished as such.

F. In certain instances specific manufacturer/model/type and catalog numbers are set out herein or on the drawings for the purpose of indicating required criteria for quality, function, sound level and acceptable physical size. Specifications, performance data, and descriptive data published by the designated manufacturer shall be taken as minimum requirements for the item to be provided.

G. Comply with manufacturer's printed instructions and recommendations as minimum criteria for the installation of equipment.

H. Where proprietary names are used, whether or not followed by the words "or as approved", they shall be subject to substitution only as approved by the Architect.

I. All materials and equipment provided under this Contract shall be completely satisfactory and acceptable in operation, performance and capacity. No approval, either verbal or written, of any drawing, descriptive data or samples of such materials, equipment and/or appurtenances, shall relieve this Contractor of his responsibility to turn over all items in perfect working order at completion of the work.

J. All material and equipment to be furnished under this contract shall be new and shall conform to the grade, quality and standards specified herein. Items of equipment shall be the latest standard product as advertised in printed catalogues by reputable manufacturers for the purpose intended and shall have replacement parts available.

2.02 *Nameplate Data*

A. Provide factory-installed, permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.

PART 3 EXECUTION

3.01 *General*

A. All construction under this contract shall be completed in a neat and craftsman-like manner. Work that, in the judgement of the Architect, is not satisfactorily installed shall be removed and replaced to the Architect's satisfaction, at the Contractor's expense.

B. Throughout construction, all work areas and storage areas shall be kept clean. The Contractor shall keep all items clean of dirt, rust, dust and fingermarks.

C. The Contractor shall furnish, set, erect, and maintain all scaffolding, aerial equipment and ladders required in the installation of this Contract work.

D. Install temporary platforms so as to be supported only by the existing steel truss framework.

E. Painting: Provide in accordance with Division 09 FINISHES Sections and as stated below.

1. Except in Mechanical Rooms, Electrical Rooms, and chase spaces all exposed items provided or installed under this Contract shall be painted.

2. Unless painting is provided by others as elsewhere specified, all painting for items furnished or installed under this Contract shall be the responsibility of this Contractor.

3. Factory-painted equipment cabinets and trim shall not be field-painted except for touching up scratches or damage where necessary to achieve like-new finish. Touching up shall be done after equipment is in its final location.

4. Paint for metal surfaces shall be Rust-o-leum or as approved, one prime coat and two finish coats of color selected by Architect.

5. Items to be painted shall be cleaned and degreased and shall be free of dirt, rust and corrosion prior to application of paint. All paint shall be applied in accordance with all the manufacturer's recommendations (i.e. temperature, dew point, ventilation).

6. All patchwork performed under this Contract shall be painted. Color shall match the color of adjacent walls, ceilings and floors in which patchwork occurs. Area to be painted shall extend a minimum of 24" all around patchwork; however, final limit shall be set by the Architect. Blend new paintwork with existing painted surfaces. Where existing finish is stained or varnished woodwork, all damaged or patched surfaces shall be restored to match the existing adjacent surface, as approved. Paint, stain, varnish and method of application shall be as set out in the specifications for General Construction, or as otherwise approved. Except where painting of patchwork is provided by others, as elsewhere specified, all painting of patchwork required under this Contract shall be the responsibility of this Contractor.

7. The General Contractor shall ensure that the painting contractor does not paint or over spray any single 4 pair horizontal telecommunications cable. Any painted or over sprayed cable shall be replaced at the painting contractor’s expense. Painting telecommunications cabling will void the cabling warranty.

3.02 *Coordination*

A. Sequence of Work

1. Provide in accordance with Division 01 Section SUMMARY.

B. Outages and Disruptions

1. Continuity of operation of all essential HVAC, plumbing and electrical items, including electrical service, lighting, outlets, power and controls for heating and cooling equipment, auxiliary systems, fire alarm, emergency lighting and power, program, sound, alarms and telephones shall be provided as required for occupancy of the premises during the construction period.

2. Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

   a. Notify Owner no fewer than fourteen days in advance of proposed interruption of electric service.

   b. Indicate method of providing temporary electric service.

   c. Do not proceed with interruption of electric service without Owner's written permission.

3. Provide temporary wiring and connections to maintain existing systems in service during construction.

4. The schedule and timing of any interruption of water, gas or electrical service or disruption of occupied areas that may affect use of the premises by the Owner and the public, shall be coordinated with the Owner and Architect. Temporary or interim use feeders and facilities shall be provided by the Contractor, as approved and/or directed, to minimize the duration and extent of outages or interruptions.

5. In areas where the construction work will interfere unduly with use of the premises, the Owner may direct that construction work be performed during time periods other than indicated above or on Saturdays, Sundays, or Holidays. Judgment as to whether such undue interference may exist shall rest solely with the Owner. Also, the Owner may require that temporary or interim use feeders and facilities shall be provided by the Contractor as approved and/or directed, to minimize the duration and extent of outages or interruptions.

6. Preparatory work shall be performed as completely as possible in each instance prior to scheduled service outages.

7. Contractor shall be responsible for any and all premium time/overtime required to perform outages and cutovers of services. Coordinate with Owner and Architect.

8. Contractor shall be responsible for any and all premium time/overtime required to complete the work in the various areas within the allotted time, as well as any premium/overtime required to install work through unaffected or remote areas from the work as necessary to maintain continuity of services and occupancy of the existing buildings, as required. Coordinate with Owner and Architect.

C. Demolition

1. Notify the Architect at least 5 days prior to commencing demolition operations.

2. Perform demolition in phases as indicated. Refer to Division 01 for additional requirements.

3. Conditions Affecting Demolition: The following project conditions apply:

   a. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.

   b. Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

   c. Provide nondestructive removal of materials and equipment for reuse or salvage as indicated on drawings.

   d. Provide dismantling of electrical materials and equipment made obsolete by these installations.

4. Examination

   a. Verify field measurements and circuiting arrangements are as shown on Drawings.

   b. Verify that abandoned wiring and equipment serve only abandoned facilities.

   c. Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner's representative before disturbing existing installation.

   d. Beginning of demolition means installer accepts existing conditions.

5. Preparation

   a. Disconnect electrical systems in walls, floors, and ceiling scheduled for removal.

   b. When work must be performed on energized equipment or circuits, use qualified personnel.

6. Demolition and Extension of Existing Electrical Work: Demolish and extend existing electrical work as shown on drawings and as described in this section.

   a. Remove, relocate, and extend existing installations to accommodate new construction.

b. All abandoned wiring shall be disconnected at both ends and removed.

c. Remove exposed, abandoned conduit, including abandoned conduit above accessible ceilings. Cut conduit flush with walls and floors, and patch surfaces.

d. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed.

e. Disconnect and remove abandoned panelboards and distribution equipment.

f. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

g. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.

h. All spent fluorescent and HID lamps and ballasts shall be disposed of by the contractor according to NEMA guidelines, the Universal Waste Rule, and the requirements of local and state authorities having jurisdiction. The Universal Waste Rule shall only apply to non-TCLP conforming lamps.

i. Repair adjacent construction and finishes damaged during demolition and extension work, as approved.

j. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

k. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

l. Maintain, restore, and provide electrical service for all receptacles, outlets, lighting fixtures and electrically operated equipment not being demolished. Intercept existing circuit, connect new circuiting into existing circuiting and extend new circuiting back to panelboard or previous "up-stream" device, which is not being removed.

m. The Contractor shall maintain the operating condition of the existing Fire Alarm System. The fire alarm system is provided under a separate contract.

7. Disposition of Equipment:

a. Unless specified, indicated, or directed otherwise, all material and equipment not intended for reuse on this project that is to be dismantled or removed under this contract, shall become Contractor's property and shall be transported from the premises by the contractor.

b. Exceptions: Contractor shall remove and transport the following items without damage to an on-site location as directed, for inspection and possible salvage by Owner:

1) Panelboards

2) Circuit Breakers and Safety Switches

3) Additional Items as the Owner sees fit during demolition

8. Hazardous Materials:

a. Hazardous materials may be present in building components to be demolished.

b. Do not disturb hazardous materials or items suspected of containing hazardous materials and immediately notify Owner and Architect.

c. Hazardous materials will be removed by Owner under separate Contract.

D. New Work

1. Coordinate electrical equipment installation with other building components.

2. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work.

3. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.

4. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

5. Coordinate connection of electrical services with equipment provided under other sections of the specifications.

6. Coordinate requirements for access panels and doors where electrical items requiring access are concealed behind finished surfaces. Verify all dimensions by field measurements.

7. Coordinate the cutting and patching of building components to accommodate installation of electrical equipment and materials.

8. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

E. Cooperation and Coordination With Other Trades

1. This Electrical Contractor must cooperate completely and coordinate work with the contractors of other trades providing equipment under this division and other

divisions of the specifications. This is particularly important in connection with Divisions 21, 22, and 23 - Mechanical.

2. Interference drawings shall be prepared as a combined effort of all trades. The Electrical Contractor shall prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations on Mylar backgrounds prepared by the Mechanical Contractor. The Mechanical Contractor shall start their drawings immediately upon award of contract. Drawings shall be at 1/4" = 1'0" scale based on sheet size and plan location and orientation as shown on the architectural drawings. All interference drawings shall be capable of being overlaid to coordinate interferences and for printing. All congested areas and mechanical room plans shall be drawn at 3/8" = 1'0" scale.

3. After the Mechanical Contractor has finished, electronic files will be forwarded to the Plumbing trade who will show and coordinate the plumbing work with the other trades. After the Plumbing trade has finished, electronic files will be forwarded to the Electrical trade who will show and coordinate their work on the combined plans.

4. Interference plans and elevations shall show in detail the location of the following items that require coordination because of size and proximity to other equipment and systems. Drawings shall show in order of installation priority within the allotted space the items prioritized in the following paragraph entitled "Space Priority".

a. In addition, show electrical work in equipment rooms.

b. On the interference drawings, show all electrical conduits that are 1-1/2" and larger.

c. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work.

d. Proposed locations of major systems, equipment and material.

e. Work in pipe spaces, chases, and trenches.

f. Exterior wall penetrations.

g. Fire-rated wall and floor penetrations.

h. Ceilings that contain piping, ductwork, or equipment in congested arrangement.

i. Equipment connections and support details.

j. Exterior underground lines in common excavation.

k. Sizes and location of required concrete pads and bases.

l. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

m. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

n. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted devices.

o. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.

5. Electronic files of the finished interference drawings shall be submitted to the Architect for record before actual installation work begins. Each trade shall make completed interference drawings available to their craft for installation of the work.

6. Individual trade interference drawings may be used as shop drawings and/or as record drawings at the completion of the project.

7. The coordination drawings shall be reviewed and approved by the Owner and Architect, and shall be signed by both the Owner and the Architect.

F. The network cabling installer shall cooperate completely and coordinate work with the Electrical Contractor and contractors of other trades. Due to the Project Schedule this Contractor will be required to phase the installation in accordance with the Electrical Contractor's work.

1. Prepare floor plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

a. Specific equipment installations, including, but not limited to racks for LAN equipment, racks for sound system equipment, cable television equipment, etc.

b. Where additional conduit sleeves are required in order to limit UTP cable length to 90 meters.

c. Wiring diagrams: Indicating field installed communication wiring and cabling layouts, equipment, and equipment connections.

G. Space Priority

1. Ensure equitable use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

a. Gravity flow piping systems

b. Vent piping systems

c. Ceiling recessed lighting fixtures

d. Concealed air terminal units, fans

e. Air duct systems

f. Forced flow piping systems

g. Electrical conduit, wiring, control wiring

2. Order of priority does not dictate installation sequence. Installation sequence shall be as mutually agreed by all affected trades.

3. Change in order of priority is permissible by mutual agreement of all affected trades.

4. The work of a particular trade shall not infringe upon the allocated space of another trade without permission of the contractor for the affected trade.

5. The work of a particular trade shall not obstruct access for installation, operation and maintenance of the Work, materials and equipment of another trade.

3.03 *Substitutions*

A. Provide in accordance with Division 01 Section SUBSTITUTION PROCEDURES and as stated below.

B. Where the contractor proposes substitute equipment, contractor to submit complete product data indicating compliance with all requirements of the documents, including performance rating, size and resistance to wear and deterioration equivalent to the specified item at least ten (10) days prior to the bid date. In instances where substituted equipment requires additional material or work beyond that shown or required by the specified item, said additional material or work shall be the responsibility of this Contractor, regardless of the trade involved.

3.04 *Submittals*

A. Provide in accordance with Division 01 Section SUBMITTAL PROCEDURES and as stated below.

B. Submit for approval a complete Material Source of Supply and Subcontractor list for all electrical work required under this project. Shop drawing submittals will not be reviewed until a complete Material Source of Supply and Subcontractor list is received. Submit this listing as a part of the submittal requirement specified in Division 01.

C. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Data submitted from subcontractors and material suppliers directly to the Architect will not be processed.

D. Prepare and submit detailed shop drawings for materials, systems and equipment as listed herein, including locations and sizes of all openings in floor decks, walls and floors.

E. The work described in any shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all trades on the job. Each submitted shop drawing shall include a certification that all related job conditions have been checked and that no conflict exists.

F. All shop drawings shall be stamped by the Contractor, indicating approval, and space shall be provided for the Engineer's stamp and the Architect's stamp.

G. All drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking and resubmittal as may be required. All submittals shall be complete and contain all required and detailed information.

H. Acceptance of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement and layout shall not relieve the Contractor from responsibility of furnishing all items of proper dimensions, weight, capacities, sizes, quantity and quality as intended by the Contract. Such acceptance shall not relieve Contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.

I. Each shop drawing shall contain job title and reference to the applicable drawing and specification article, including the contractor’s drawings, specifications and verification of compatibility with the systems involved.

J. Individual shop drawing submittals shall be provided for each specific material, system or equipment as identified herein. Submittals provided in other than this manner will be return without review.

K. All nameplate data shall be complete at time of equipment submittals - refer to other sections for identification requirements.

L. For each room or area of the building containing panelboards, telephone backboards, cabinets, coordination drawings are required to be submitted for review and acceptance at the time of the equipment submittal.

M. Equipment shall not be ordered or purchased until the shop drawing approval is received.

N. Shop Drawings shall show conformance with specified electrical characteristics, or Contractor shall assume responsibility for all deviations including all additional costs involved for the deviations.

O. The following is a list of some important material, equipment and systems that require shop drawing approval, refer to each section of this specification for additional submittal requirements:

1. Low Voltage Electrical Power Cables

2. Grounding and Bonding Equipment

3. Hangers and Supports

4. Raceways and Boxes

5. Lighting Controls

6. Panelboards

7. Wiring Devices

8. Fuses

9. Enclosed Switches and Circuit Breakers

10. Light Fixtures

11. Data network cabling, jacks, patch panels, faceplates

12. Data network racks

P. Product Options:

1. The product manufacturers listed in each section are either the product the design is based on or a product that the Engineer feels would be an acceptable substitution if that product can meet the intent of the written specifications and the scheduled capacities. The Electrical Contractor is responsible for ensuring that the substituted product complies with the intent of the specifications, the scheduled capacities and the drawings. Substitutions of manufacturers not listed are not permitted unless prior approval is obtained from the Engineer as required by Part 3.3, SUBSTITUTIONS, of this specification section.

2. It will be the responsibility of the Electrical Contractor to pay any and all costs associated with any approved substitutions that impact the architectural layout, structure, electrical system(s), mechanical systems, and/or the plumbing systems, due to an increase in physical dimensions, weight, electrical requirements, connection sizes, etc., between the approved substitution item and the equipment item scheduled and/or indicated as the basis of design.

Q. In order for the manufacturer to certify the local area network cabling system, the system components must meet the requirements of the manufacturer. Review the system with the manufacturer in accordance with their system certification program and provide a letter from the manufacturer documenting the following;

1. That the Contractor is a manufacturer certified installer.

2. That all the materials in the submittal are in accordance with the manufacturer's certification program.

3. That the manufacturer has reviewed the entire system in accordance with their certification program and the system is in compliance.

4. A system that does not have a manufacturer's certification will not be accepted.

3.05 *Quality Assurance and Testing*

A. Provide in accordance with Division 01 Section QUALITY REQUIREMENTS.

B. Provide products that are listed and labeled by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Refer to all Division 26 specification sections for additional testing requirements.

3.06 *Temporary*

A. Provide in accordance with Division 01 Section TEMPORARY FACILITIES AND CONTROLS and as stated below.

B. The Electrical Contractor shall provide temporary electric services to the construction areas at locations acceptable to the General Contractor. The service to be provided shall be from the existing electrical system and shall be 3 phase, 4 wire, 208Y/120V, 100 ampere minimum with the necessary distributing facilities. The service shall be installed within fifteen (15) days after written request has been made to the Electrical Contractor, with copies to the Architect and Owner by any contractor requiring such service.

C. The Electrical Contractor shall provide temporary electric services to the construction trailers at locations acceptable to the General Contractor. The service to be provided shall be from the existing electrical system and shall be 3 phase, 4 wire, 208Y/120V, 100 ampere minimum with the necessary distributing facilities. The service shall be installed within fifteen (15) days after written request has been made to the Electrical Contractor, with copies to the Architect and Owner, by any contractor requiring such service.

D. Power consumption shall not disrupt Owner's need for continuous service.

E. The Contractor shall provide power outlets for construction operations, branch wiring, distribution boxes. Each individual contractor will provide flexible power cords as required.

F. Power required for tools and operating equipment used for the installation of equipment, that exceeds the power available, shall be temporarily installed and removed by the Contractor requiring it.

G. Distribution wiring and equipment/devices used for temporary services shall not be installed as part of the permanent building distribution system.

H. Permanent distribution wiring and equipment/devices shall not be used for temporary services.

I. The Contractor shall provide temporary lights and all associated wiring as required by the individual prime contractors.

J. Contractor to remove all temporary wiring and temporary lighting.

3.07 *Delivery, Storage, and Handling*

A. Provide in accordance with Division 01 Section PRODUCT REQUIREMENTS and as stated below.

B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for distinct identification; adequately packaged and protected to prevent damage during shipment, storage and handling.

C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

D. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.08 *Cutting and Patching*

A. Provide in accordance with Division 01 Section EXECUTION.

3.09 *Installations*

A. Provide in accordance with Division 01 Section EXECUTION and as stated below.

B. Verify all dimensions by field measurements.

C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

D. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

E. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible.

F. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for installations of cabling. Arrange such chases, slots and openings such that UTP cable does not exceed 90 meters.

G. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

H. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.

I. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.

J. Install access panel or doors where units are concealed behind finished surfaces.

K. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

L. Obtain written approval of locations of all electrical devices from the Owner and Architect prior to rough-in. The owner reserves the right to move any or all electrical devices prior to rough-in, at no additional cost.

M. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

N. Obtain approval from the Architect before drilling or cutting structural members.

O. Holes cut into reinforced concrete beams or in concrete shall not cut reinforcing bars. If the Contractor cuts into any reinforcing bars, stop work and notify the Architect immediately.

P. Refer to equipment specifications in Divisions 02 through 33 for rough-in requirements for equipment furnished under other contracts.

Q. Door swings may vary from plans. Make note of actual door swings at time of rough-in. Do not install switches or other items behind the swing of any door.

R. The installation shall be subject to such revisions as may be necessary to overcome building obstructions.

S. Provide connections to all electrically operated equipment furnished under other sections and/or divisions of this project specification.

T. Inspect areas and conditions under which electrical connections for equipment that will be installed and notify the Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor.

U. Verify that equipment is ready for electrical connection, wiring, and energization.

V. Install all in-line power control, protection, and disconnection devices furnished by others that are not an integral part of the equipment. These devices shall be located in accordance with the Contractor furnishing the devices and the requirements of the NEC.

W. Provide for proper rotation of all three phase motors.

X. Work improperly placed because of Contractor's failure to obtain the above information shall be relocated and reinstalled as directed, without additional costs to the Contract. No charges shall be made in location of equipment without prior written approval.

3.10 *Final Cleaning*

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES.

3.11 *Warranties*

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES and as stated below.

B. Refer to individual equipment specifications for additional warranty requirements. If a contradiction exists, the most demanding requirements shall prevail.

C. Compile and assemble the warranties specified in Division 26 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

D. Provide complete warranty information for each item to include date of beginning of warranty or bond; duration of warranty or bond; and names, address, and telephone numbers and procedures for filing a claim and obtaining warranty services.

E. Warranty and Certification of the Data Network Wiring and connectors:

1. The Contractor shall provide a minimum 20-year performance and product warranty that all cable, connectors, and connecting hardware shall be free from defects in material, workmanship, and fabrication.

2. The system shall be certified by the cable/connector manufacturer and warranted for the specified performance for a minimum of 20 years. The Contractor shall conform to the manufacturer's certification program including testing and the submittal of all required documentation to the manufacturer.

3. The Contractor shall obtain from the manufacturer, a "systems application assurance" warranty for a minimum of 20 years.

4. The Contractor shall obtain, from the manufacturer, a Registration Document and Certificate for the specific installation. Upon receipt of the Registration Document and Certificate the Contractor shall forward a copy to the Engineer and deliver the original to the Owner.

F. Submit a single warranty stating that all portions of the work are in accordance with Contract requirements. Warrant all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term shall apply. Within 24 hours after notification, correct any deficiencies that occur during the warranty period at no additional cost to Owner, all to the satisfaction

of the Owner and Architect. Obtain similar warranties from subcontractors, manufacturers, suppliers and sub-trade specialists.

G. Any material, equipment or appurtenance whose operation or performance does not comply with the requirements of the Contract Documents or that are damaged prior to acceptance will be held as defective and shall be removed and properly replaced at no additional cost to the Owner.

3.12 *Maintenance Manuals*

A. Provide in accordance with Division 01 Section OPERATION AND MAINTENANCE DATA and as stated below.

B. Include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

5. Provide a cover sheet for each manual including the project name, Architect's name and contact information, Engineer's name and contact information, and Division 26 contractor's name and contact information.

6. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.

7. Manufacturer's data of each piece of equipment including:

a. Installation instructions.

b. Drawings and Specifications.

c. Parts list, including recommended items to be stocked.

d. Complete wiring diagrams.

e. Marked or changed prints locating all concealed parts and all variations from the original system design.

f. Test and inspection certificates.

3.13 *Record Documents*

A. Provide in accordance with Division 01 Section PROJECT RECORD DOCUMENTS and as stated below.

B. Indicate installed conditions for the following:

1. Raceway systems, size and location, for both exterior and interior.

2. Locations of control devices.

3. Distribution and branch electrical circuitry.

4. Fuse and circuit breaker size and arrangements.

5. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

6. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

C. Provide a list of all active devices installed under this contract. This list shall include both contractor furnished, contractor installed and owner furnished, contractor installed equipment.

1. In Microsoft Excel format, include the following information:

a. Device Symbol as Indicated on As-Built Drawings

b. Location (Room #)

c. Manufacturer/Model

d. Serial Number

e. Manufacturer Warranty Valid Through Date

f. Static IP address (provide address) or DHCP (address not required)

g. MAC address

h. Login Credentials

i. Replacement Cost (for owner's insurance)

3.14 *Demonstration and Training*

A. Provide in accordance with Division 01 Section DEMONSTRATION AND TRAINING and as stated below.

B. After the tests and adjustments have been made, approved factory-authorized system representatives and the Contractor shall fully instruct Owner in all details of operation and maintenance of equipment installed under this Contract. Dates and times of such instructions shall be as directed by Owner, including any necessary weekend or after-hours instruction.

C. The following is a list systems that require Demonstration and Training, refer to the individual specification sections for additional training requirements:

1. Lighting Controls

2. Panelboards

3. Enclosed Switches and Circuit Breakers

END OF SECTION 26 01 00

SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. Section Includes:

1. Copper building wire rated 600 V or less.

2. Metal clad cable, Type MC, rated 600 V or less.

3. Connectors, splices, and terminations rated 600 V and less.

1.03 *Submittals*

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data: Submit manufacturer's data for electrical wires, cables and connectors.

PART 2 PRODUCTS

2.01 *Copper Building Wire*

A. Description: Flexible, insulated, drawn copper current-carrying conductor with an overall insulation layer and jacket, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Cerro Wire

2. Colonial Wire and Cable Company

3. Encore Wire Corporation

4. General Cable Corporation

5. Okonite Company

6. Service Wire Company

7. Southwire Company

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. RoHS compliant.

3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN/THWN-2: Comply with UL 83.

2.02 *Metal Clad Cable, Type MC*

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. AFC Cable Systems

2. Encore Wire Corporation

3. Okonite Company

4. Service Wire Company

5. Southwire Company

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. Comply with UL 1569.

3. RoHS compliant.

4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits: Single circuit and multi-circuit with color-coded conductors as required.

E. Conductors for branch circuits, #8AWG and smaller: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors

F. Conductors for feeders, #6 and larger: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors

G. Ground Conductor: Insulated.

H. Conductor Insulation: Type THHN/THWN-2: Comply with UL 83.

I. Armor: Steel, interlocked.

2.03 *SO Multi-Conductor Flexible Cord*

A. Cord Construction: Oil-resistant thermoset insulated type with identified equipment ground conductor, suitable for (extra) hard usage in damp locations.

B. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

2.04 *Connectors and Splices*

A. Description: Factory fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use. Use connectors with temperature ratings equal to or greater than those of the wires upon that are used.

B. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. 3M Electrical Products
2. AFC Cable Systems
3. Burndy
4. Hubbell Power Systems
5. Ideal Industries
6. ILSCO
7. NSi Industries
8. O-Z/Gedney
9. TE Connectivity

10. Thomas and Betts Corporation

C. Jacketed Cable Connectors: For steel jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Match conductor material.

2. Termination: Compression.

2.05 *Color Coding:*

A. Color Coding of Conductors: Factory applied the entire length of conductors, provide the following:

1. 208/120V through 240V Conductors:

a. Phase A: Black

b. Phase B: Red

c. Phase C: Blue

d. Neutral: White

2. Travelers for 3 way/4 way switches shall be purple.

PART 3 EXECUTION

3.01 *Delivery, Storage and Handling*

A. Each length, bundle, or reel of wire and cable delivered to job site shall bear manufacturer's name, catalog number and trademark, UL label, type letters, size, length and manufacturing date.

B. Deliver wire and cable properly packaged in factory fabricated type containers, or wound on NEMA specified type wire and cable reels.

C. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris, and traffic.

D. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

3.02 *Conductor Material Applications*

A. Feeders: Copper, stranded.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.03 *Conductor Insulation and Multi-Conductor Cable Applications and Wiring Methods*

A. Feeders:

1. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

2. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

3. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Metal clad cable, Type MC.

4. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

B. Branch Circuits:

1. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

2. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway and /or Metal clad cable, Type MC. Provide Type MC cable only for concealed branch circuit wiring in drywall partitions and above accessible ceilings. MC cable shall terminate in a junction box above the finished ceiling of space served by circuiting. All homeruns from branch panelboards shall be routed to space served in EMT conduit, unless otherwise specified. MC cable will not be used as the homerun from space served to panelboard of origin, unless otherwise specified.

3. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

C. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire mesh, strain relief device at terminations to suit application.

3.04 *Installation of Conductors and Cables*

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Provide wire and cable suitable for temperature, conditions and location; and install in compliance with the NEC.

C. Minimum wire size shall be #12 AWG for all wiring, with the following exceptions:

1. If the distance between the panelboard and the first circuit load is greater than 100 feet, the minimum wire size shall be #10 AWG.

2. All emergency lighting circuit wiring shall be #10 AWG or larger.

3. Conductors and cables for communications and signal systems shall be as described in respective specification sections and as recommended and approved by manufacturer.

D. Provide dedicated neutrals for all single-phase branch circuits.

E. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

F. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

G. Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips, that will not damage cables or raceway.

H. Pull conductors simultaneously where more than one is being installed in same raceway.

I. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

J. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

K. MC cable shall be neatly trained and supported clear of ceiling tile and ceiling grid by means of metallic straps or clips. The use of nylon tie wraps to support MC cable from the structure is prohibited. Supports for MC cable shall be independent from supports for other systems (i.e. light fixtures, ceiling grid, mechanical systems) and the supports for the MC cable shall be directly connected to the structure.

L. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

M. Conductor/cable supports for vertical runs shall be provided in top cabinet or pull box of all feeders in accordance with NEC requirements.

3.05 *Connections*

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

B. Splices:

1. Keep conductor splices to minimum.

2. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3. Splicing of #10 wires and smaller shall be made with Scotchlok or as approved.

4. Splicing of #8 wire and larger shall be made by means of compression type connectors and installed with a proper tool and then insulated to same dielectric value as the original insulation with plastic tape.

5. Splices are not permitted in conductors larger than #10, except where specifically called for.

6. All splicing shall be made in outlet boxes or junction boxes.

7. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.06 *Identification*

A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

3.07 *Sleeve and Sleeve Seal Installation for Electrical Penetrations*

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.08 *Firestopping*

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.09 *Field Quality Control*

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform each of the following visual and electrical tests:

1. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.

2. Test bolted connections for high resistance using one of the following:

    a. A low-resistance ohmmeter

    b. Calibrated torque wrench

    c. Thermographic survey

3. Inspect compression-applied connectors for correct cable match and indentation.

4. Inspect for correct identification.

5. Inspect cable jacket and condition.

6. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.

7. Continuity test on each conductor and cable.

8. Uniform resistance of parallel conductors.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.

2. Results that comply with requirements.

3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 23 - CONTROL VOLTAGE COMMUNICATION CABLING

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

B. Requirements of the following Division 26 Sections apply to this section:

1. Basic Electrical Requirements.

1.02 *Summary*

A. This Section includes cables designed and used for electrical transmission in control, data, and signal circuits including:

1. Twisted Pair cable

2. Coaxial cable

3. Video Pair cable

1.03 *Submittals*

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Submittals shall be made with the corresponding system submittal as complete systems including all required accessories and special installation tools (i.e., termination hardware).

C. Product Data for control/signal transmission cable and connectors, including the following cable transmission characteristics:

1. Mutual Capacitance

2. DC Resistance

3. Characteristic Impedance

4. Attenuation

5. Near-end Crosstalk (NEXT)

6. Nominal Velocity of Propagation

D. Manufacturers complete installation instructions including the following information:

1. Minimum bend radius

2. Maximum pulling tension

3. Recommended installation of pulling points (i.e., every 180 degrees of bends in the conduit, or every 150 feet of conduit)

4. Recommended pulling lubricants

E. Product Certificates signed by the communication system manufacturers, certifying that the cables and termination hardware is suitable for the connected equipment and is certified to meet the standards described in Quality Assurance below.

F. Provide information regarding all termination, splitting and splicing connectors that will be required to complete this installation. This information shall include complete specifications and installation instructions including tightening requirements.

1.04 *Quality Assurance*

A. Connected Equipment Manufacturer Approval: Where cables specified in this Section are used to provide signal paths for systems specified in other sections of these Specifications or for systems furnished under other contracts, obtain review of the cable characteristics and approval for use with the connected system equipment by the connected equipment manufacturers.

B. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code."

C. Toxicity: Comply with applicable codes and regulations regarding toxicity of combustion products of materials used in control/signal transmission media.

D. UL Compliance: Comply with applicable requirements of UL Standard 910 "Test Method for Fire and Smoke Characteristics of Cables Used in Air Handling Spaces". Provide products that are UL-listed and labeled for such use.

E. NEMA/ICEA Compliance: Comply with NEMA/ICEA Standard WC 41, "Coaxial Communication Cable."

F. Comply with the following Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA) Standards:

1. EIA/TIA-568, "Commercial Building Telecommunications Wiring Standard"

2. EIA/TIA-569, "Commercial Building Standard for Telecommunications: Pathways and Spaces"

3. EIA/TIA-570, "Residential and Light Commercial Telecommunications Wiring Standard"

4. TIA/EIA-606, "The Administration Standard of the Telecommunications Infrastructure of Commercial Building"

5. TSB-36, Technical Systems Bulletin, "Additional Cable Specifications for Unshielded Twisted-Pair Connecting Hardware"

6. TSB-40, Technical Systems Bulletin, "Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware"

7. EIA Standards EIA-230, "Color Marking of Thermoplastic Wire" and

8. EIA-258, "Semi-Flexible Air Dielectric Coaxial Cables and Connectors, 50 Ohms."

G. MIL-SPEC Compliance: Comply with MIL-C-3093, "Telephone Cable; Inside Distribution Wiring," MIL-C-55021, "Twisted-Pair and Triplet Cables; Hookups General Specifications," MIL-C-17/28, "Radio Frequency Flexible Coaxial Cables, 50 Ohms," and MIL-C-17/29, "Radio Frequency Flexible Coaxial Cables, 75 Ohms."

1.05 *Delivery, Storage, and Handling*

A. Deliver cable factory packaged in containers or reels. Store in clean dry space and protect products from damaging fumes and traffic. Handle wire and cable carefully to avoid damage.

PART 2 PRODUCTS

2.01 *General*

A. All cable installed in cable tray shall have a plenum rating.

2.02 *Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Cable:

a. AT&T Network Systems

b. The Siemon Company

c. Belden Division; Cooper Industries

d. Mohawk Wire & Cable Corporation

e. West Penn Wire Corporation

f. AMP

2. Connectors:

a. Thomas & Betts Corporation

b. 3M Company

c. Blounder Tongue

d. Macom

e. AMP

2.03 *Control/Signal Transmission Cable and Connectors*

A. General: Provide control/signal transmission cable and connectors of manufacturer's standard materials as indicated on the drawings. All cables shall be designed and constructed as recommended by the system/equipment manufacturer, for a complete installation and for applications indicated.

2.04 *Applications*

A. Install control/signal cables and connectors for the following systems:

1. Audio/Visual systems

PART 3 EXECUTION

3.01 *Installation of Control/Signal Cable and Connectors*

A. Conductors and cables for communications and signal systems shall be installed with a minimum 18" clearance from light fixtures, electrically operated equipment and all wiring operating at 120 or more volts.

B. Conductors and cables for communications and signal systems shall be type, size and insulation as recommended by manufacturer and approved. Install in accordance with manufacturer's written instructions and in compliance with NEC.

C. Coordinate installation with other Work.

D. Install without damaging conductors, shield, or jacket.

E. Do not either in handling or installation bend cable to smaller radii than minimum recommended by the manufacturer.

F. Ensure that minimum manufacturer's recommended pulling tensions are not exceeded.

G. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.

H. Use pulling compound or lubricant where necessary; compound used must be approved by the cable manufacturer.

I. Install exposed cable, parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

J. No splices are allowed except at indicated splice points.

K. Use splice and tap connectors that are compatible with media material.

L. Tighten connectors and terminals, including screws and bolts in accordance with manufacturer's published instructions or torque tightening values.

3.02 *Color Coding*

A. All wiring for communications and signal systems shall be color coded, using black, red, white, yellow, blue and brown with tracers as required. There shall be no two wires of same trace color in the same cable. This color coding shall be consistent and continuous throughout the system.

3.03 *Training*

A. Provide adequate length of conductors within electrical enclosures and at punch down blocks. Train the conductors to termination points with no excess.

3.04 *Field Quality Control*

A. Prior to usage, test wiring for electrical continuity and for short circuits. In addition, test the cable installation with a time domain reflectometer with strip chart recording capability and anomaly resolution to within one foot in runs up to 1,000 feet in length.

B. Test all cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.

C. Documentation: Use the above time domain reflectometer to make a strip chart recording of transmission characteristics, wave form, and performance of all segments of the installation at the time of commissioning. Bind the recordings in a cable record book indexed for easy reference during future maintenance operations and turn book over to the Owner's authorized representative.

D. Replace malfunctioning transmission media with new materials, then retest until satisfactory performance is achieved.

3.05 *Commissioning*

A. Subsequent to hookups of control/signal transmission media, operate control/signal systems to demonstrate proper functioning. Replace malfunctioning media with new materials, and then retest until satisfactory performance is achieved.

END OF SECTION 26 05 23

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1.03 *Submittals*

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product data for ground rods, connectors and connection materials, and grounding fittings.

2. Qualification Data: For testing agency and testing agency's field supervisor.

3. Field quality control reports.

1.04 *Quality Assurance*

A. Testing Agency Qualifications: Certified by NETA.

PART 2 PRODUCTS

2.01 *System Description*

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Materials: Copper with 98% conductivity.

2.02 *Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. B-Line Systems Inc.

2. Burndy Corporation

3. Erico International

4. ILSCO

5. O-Z/Gedney

6. Thomas and Betts Corporation

2.03 *Conductors*

A. Comply with Division 26 Section 26 05 19 " Low Voltage Electrical Power Cables"

B. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction, green insulation.

C. Bare Copper Conductors: Stranded Conductors: ASTM B 8.

D. Copper Bonding Conductors:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

2. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

3. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

E. Grounding Bus: Pre-drilled rectangular bars of annealed copper, 24 inch long, 1/4 inch by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

F. Telecom System Grounding Riser Conductor: Telecommunications Grounding Riser shall be in accordance with J STO-607A. Use a minimum 1/0 AWG insulated stranded copper grounding conductor unless indicated otherwise.

2.04 *Connectors*

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors:

1. Exothermic welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. nVent ERICO Cadweld

b. Hubbell Continental Industries thermOweld

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar or compression type, copper or copper alloy, with two wire terminals.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Bonding Strap: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

G. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 cm. Protect braid with copper bolt hole ends with holes sized for 3/8" dia. bolts.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

2.05 *Grounding Electrodes*

A. Ground Rods: 13-mil copper-bonded steel, 3/4 inch by 8 feet.

2.06 *Accessories*

A. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 EXECUTION

3.01 *Applications*

A. Equipment Grounding:

1. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

a. Feeders and branch circuits.

b. Lighting circuits.

c. Receptacle circuits.

d. Single-phase motor and appliance branch circuits.

e. Three-phase motor and appliance branch circuits.

f. Flexible raceway runs.

g. Metal-clad cable runs.

2. Air Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

B. Grounding and Bonding for Gas Piping: Bond each above ground portion of gas piping system downstream from equipment shutoff valve.

C. Telecommunications Grounding

1. Install ground bus in rooms housing service equipment and elsewhere as indicated on drawings. Install horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

2. Provide a #3/0 AWG green insulated copper conductor, unless noted otherwise, from the grounding electrode system to each ground bus location.

D. Service Grounding

1. Connect equipment grounding conductors and grounding electrode conductors to the ground bus.

2. Install a main bonding jumper between the neutral and ground buses.

3. Metallic Water Service Pipe:

a. Provide insulated copper ground conductors, sized as indicated, from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings.

b. Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

4. Grounding Triad: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

E. For raceways used as the ground path, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing.

3.02 *Installation*

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Terminate insulated equipment grounding conductors with pressure-type grounding lugs.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment. Use braided type bonding jumpers for flexible bonding and grounding connections.

C. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.

4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

6. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A.

7. Exothermic Welded Connections:

    a. Comply with manufacturer's written recommendations.

    b. Use for connections to structural steel and for underground connections.

    c. Install at connections to ground rods.

    d. Comply with AWS Code for procedures, appearance, and quality of welds; and methods used in correcting welding work.

    e. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

8. Provide connections as follows:

    a. Equipment Grounding Conductor Terminations: Bolted connectors.

    b. Pipe Grounding Conductor Terminations: Bolted connectors.

    c. Connections to Structural Steel: Welded connectors.

D. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

    1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

    2. Use exothermic welds for all below-grade connections.

E. Cleaning and Adjusting: Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work to their original condition. Include necessary topsoil, fertilizing, liming, seeding, sodding, sprigging, or mulching. Restore disturbed paving as required.

F. Bond all metallic cable sheaths in multi-pair communications cables together at each splicing and/or terminating location to provide 100 percent metallic sheath continuity throughout the communications distribution system.

    1. At terminal points, install a cable shield bonding connector provide a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source like the rack or cabinet ground bar.

    2. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is provided

as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.

3.03 *Field Quality Control*

A. Independent Testing Organization: Arrange and pay for the services of a qualified independent electrical testing organization to perform tests described below.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

c. Prepare test and inspection reports.

d. Excessive Ground Resistance: If resistance to ground exceeds 5 ohms, notify Engineer promptly and include recommendations to reduce ground resistance.

e. Provide approved method to reduce ground resistance and retest.

C. Grounding system will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. Section Includes:

1. Steel slotted support systems.

2. Aluminum slotted support systems.

3. Nonmetallic slotted support systems.

4. Conduit and cable support devices.

5. Structural steel for fabricated supports and restraints.

6. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

7. Fabricated metal equipment support assemblies.

1.03 *Submittals*

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions.

PART 2 PRODUCTS

2.01 *Support, Anchorage, and Attachment Components*

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

    a. B-Line/Eaton

    b. Caddy/Pentair

    c. Flex-Strut, Inc.

    d. G-Strut/Gregory Industries, Inc.

    e. Haydon Corporation

    f. Minerallac Company

    g. Power-Strut/Atkore

    h. Superstrut/Thomas & Betts

    i. Unistrut/Aatkore

    j. Westrut/Wesanco

2. Standard: Comply with MFMA-4 factory fabricated components for field assembly.

3. Material for Channel, Fittings, and Accessories: Steel.

4. Channel Width: Selected for applicable load criteria.

5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

6. Connect with machine bolts to form rigid supports.

7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

    a. B-Line/Eaton

b. Empire Industries

c. Hilti, Inc.

d. MKT Anchoring Systems

e. Ramset/ITW

f. Rawlplug

g. Red Head/ITW

h. Simpson Strong-Tie Company

2. Powder Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Mechanical Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

4. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

5. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

6. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M,Grade A325 (Grade A325M).

7. Toggle Bolts: Stainless steel springhead type.

8. Hanger Rods: Threaded steel.

PART 3 EXECUTION

3.01 *Application*

A. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

B. Boxes, Enclosures and Cabinets:

1. Install surface mounted cabinets with minimum of four anchors.

2. In wet and damp location use steel channel supports to stand cabinets one inch off wall.

3. Use sheet metal channel to bridge studs above and below cabinets recessed in hollow partitions.

C. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

D. Use vibration and shock resistant fasteners for attachments to concrete slabs.

E. Provide vibration and shock resistant fasteners for all moving equipment where the energy of the vibration is of sufficient magnitude to produce perceptible vibration or structure transmitted noise in occupied areas. Isolation equipment shall be selected, installed and adjusted in accordance with manufacturer's recommendations. All equipment and material shall be installed so as to operate without objectionable noise or vibration as determined by Architect and Owner. Should such objectionable noise or vibration be produced and transmitted to occupied portions of the building by apparatus, piping or other parts of this work, any necessary changes as approved shall be made by the Contractor.

3.02 *Support Installation*

A. Unless otherwise indicated, fasten all electrical items and their supporting hardware securely to the building structure.

B. Coordinate with the building structural system and other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Raceway Support Methods:

1. In addition to methods described in NECA 1, conduit may be supported by openings through structure members, according to NFPA 70.

2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 pounds, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.

3. Support individual horizontal raceways by separate pipe hangers.

4. Support parallel runs of horizontal raceways together on trapeze-type hangers.

5. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways.

6. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

7. Secure raceways to steel slotted supports with spring nuts using spring friction action for retention in support channel.

8. Spring steel fasteners may be used only for 3/4" raceways above suspended ceilings. For hanger rods with spring steel fasteners, use 1/4 inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

9. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals. Install simultaneously with installation of conductors.

D. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 pounds.

E. Mounting and Anchorage of Surface Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

F. Install hangers, supports, clamps and attachments to support raceways, boxes, enclosures and cabinets properly from building structure.

G. Install supports with spacings indicated and in compliance with NEC requirements.

H. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

I. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

J. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures.

K. The use of clips or clip-on type supports is not acceptable.

3.03 *Painting*

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

C. Division 08 Section "OPENINGS" for Access Doors.

1.02 *Summary*

A. This Section includes raceways for electrical wiring. Types of raceways in this section include the following:

1. Conduits and fittings

2. Boxes, enclosures, and cabinets

3. Wireways and auxiliary gutters

4. Surface raceways

5. Access doors

1.03 *Submittals*

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data: Submit manufacturer's data for the following:

a. Conduits and fittings

b. Boxes, enclosures, and cabinets

c. Wireways and auxiliary gutters

d. Surface raceways

e. Access doors

PART 2 PRODUCTS

2.01 *Metal Conduits and Fittings*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. AFC Cable Systems/Konkore
2. Allied Tube & Conduit
3. Anamet Electrical, Inc.
4. Arlington
5. Bridgeport
6. Calconduit
7. Crouse-Hinds/Eaton
8. Electri-Flex
9. Flexotek
10. KonKore
11. Korkap
12. NEC, Inc.
13. O-Z/Gedney
14. Patriot Aluminum Products
15. Perma-Cote
16. Phoenix
17. Picoma Industries, Inc.
18. Plasti-Bond
19. RACO/Hubbell
20. Republic Conduit
21. Southwire Company
22. Teddico Electrical Products

23. Thomas & Betts/ABB

24. Topaz Electric

25. Western Tube

26. Wheatland Tube

B. Metallic Conduit: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. Electrical Metallic Tubing (EMT): Comply with ANSI C80.3 and UL 797.

2. Flexible Metal Conduit (FMC): Comply with UL 1; zinc-coated steel.

3. Liquid-tight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket and complying with UL 360.

4. Rigid Metal Conduit (RMC): Comply with ANSI C80.1 and UL 6.

C. Metal Fittings: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT: Steel, compression type.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

3. Fittings for FMC:

a. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

b. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

4. Fittings for LFMC: Cadmium plated, steel fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.

5. Fittings for RMC: Threaded.

6. Joint Compound for RMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 *Nonmetallic Conduits and Fittings*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. AFC Cable Systems
2. Allied Tube & Conduit
3. Anamet Electrical, Inc.
4. Cantex, Inc.
5. Electri-Flex
6. FRE Composites
7. Heritage Plastics
8. Kraloy
9. National Pipe & Plastics
10. RACO/Hubbell
11. Southern Pipe, Inc.
12. Teddico Electrical Products
13. Thomas & Betts, Corporation
14. Topaz Electric
15. United Fiberglass

B. Nonmetallic Conduit: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. Rigid Nonmetallic Conduit (RNC): Type EPC-40-PV or EPC-80-PV, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
2. Electrical Nonmetallic Tubing (ENT): Comply with NEMA TC 13 and UL 1653.

C. Nonmetallic Fittings: Listed and labeled for type of conduit, location, and use.

1. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
2. Solvents and Adhesives: Provide product and installation as recommended by conduit manufacturer.

2.03 *Metal Wireways and Auxiliary Gutters*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. B-Line/Eaton
2. Cope
3. Hoffman/Pentair
4. MonoSystems, Inc.
5. Schneider Electric

B. Wireways and Gutters:

1. Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R, unless otherwise indicated, and sized according to NFPA 70.
2. Finish: Manufacturer's standard enamel finish.
3. Wireway Covers: Hinged type unless otherwise indicated.
4. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.04 *Surface Raceways*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Hubbell, Inc.
2. MonoSystems, Inc.
3. Panduit Corp.
4. Wiremold/Legrand

B. Listing and Labeling: Surface raceways and service poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

D. Service Poles: Aluminum with clear anodized finish.

E. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate as required for complete system.

2.05 *Boxes, Enclosures, and Cabinets*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Adalet
2. Appleton Electric/Emerson
3. Cope
4. Crouse-Hinds/Eaton
5. FSR Inc.
6. Hoffman/Pentair
7. Kraloy
8. Milbank Manufacturing
9. OZ/Gedney
10. RACO/Hubbell
11. Spring City Electrical Manufacturing
12. Steel City/Thomas & Betts Company
13. Topaz Electric

B. Device Boxes:

1. Provide size as required by drawings, minimum 2-1/8 inches deep. Boxes shall be one-piece type, gangable boxes are prohibited.
2. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
3. Cast Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
4. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 pounds. Outlet boxes designed for attachment of luminaires weighing more than 50 pounds shall be listed and marked for the maximum allowable weight.

5. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

C. Pull and Junction Boxes:

1. Sheet Metal Pull and Junction Boxes: NEMA OS 1.

2. Cast Metal Pull and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

3. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

D. Cabinets and Hinged Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: 14 gauge steel minimum, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: Fiberglass.

3. Metal barriers to separate wiring of different systems and voltage.

4. Key latch to match panelboards.

5. Accessory feet where required for freestanding equipment.

6. Provide painted removable internal mounting panel for component installation.

E. Accessories:

1. Provide accessories as required for each installation.

2. Provide box supports, mounting ears and brackets, box extension rings, fixture studs, cable clamps and metal straps for supporting boxes, that are compatible with boxes being used to fulfill installation requirements for individual wiring situations.

3. Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes to suit respective installation requirements and applications.

4. Provide stainless steel screws and hardware unless noted otherwise.

2.06 *Access Doors*

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babcock-Davis

2. JL Industries, Inc.

3. Karp Associates, Inc.

4. Milcor

5. Nystrom, Inc.

B. General:

1. Provide access door and frame assemblies manufactured as integral units ready for installation.

2. Provide factory fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

C. Materials:

1. Face of door flush with frame, with exposed flange and concealed hinge.

2. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory finished.

3. Frame Material: Same material and thickness as door.

4. Latch and Lock: Cam latch, screwdriver operated

5. Fire Rated Units:

a. Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

b. Fire-Resistance Rating: Not less than that of adjacent construction.

c. Provide with UL label.

PART 3 EXECUTION

3.01 *Application*

A. Raceways:

1. Minimum Raceway Size: 3/4-inch trade size.

2. Indoor Installations: Apply raceway products as specified below unless otherwise indicated:

a. Exposed: EMT.

b. Concealed in Ceilings and Interior Walls and Partitions: EMT or MC cable. Provide Type MC cable only for concealed branch circuit wiring in drywall partitions and above accessible ceilings. MC cable shall terminate in a junction box above the finished ceiling of space served by circuiting. All homeruns from branch panelboards shall be routed to space served in EMT conduit, unless otherwise specified. MC cable will not be used as the homerun from space served to panelboard of origin, unless otherwise specified.

c. Concealed in masonry walls: PVC.

d. Final connection to recessed and semi-recessed lighting fixtures, not to exceed 72": FMC.

e. Damp or Wet Locations: RMC.

f. Tunnels: RMC.

g. Connection to Vibrating Equipment (Including Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

h. Embedded in Slabs (on metal deck): PVC

3. Outdoor Installations: Apply raceway products as specified below unless otherwise indicated:

a. Exposed Conduit: RMC.

b. Concealed Conduit, Aboveground: RMC.

c. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

4. Raceway Fittings: Compatible with raceways and suitable for use and location.

a. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.

b. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

c. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

d. Damp or Wet Locations: Watertight fittings.

e. Tunnels: Watertight fittings.

B. Boxes, Enclosures, and Cabinets

1. Provide boxes, enclosures and cabinets and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements, unless drawings indicate a more stringent requirement:

a. Interior Dry Locations: Sheet steel, NEMA type 1.

b. Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R, with threaded hub(s) and gasketed weatherproof cover.

C. Access Doors:

1. Where installed in a fire-rated wall or ceiling, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

3.02 *Installation*

A. General:

1. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems".

2. Complete installation of raceways, boxes, enclosures, and cabinets before starting conductor installation.

3. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

4. Support conduit within 12 inches of boxes, enclosures or cabinets to which attached and within 12 inches of change of direction.

5. Do not install aluminum boxes or fittings in contact with concrete or earth.

6. Install raceways square to boxes, enclosures and cabinets and terminate with locknuts. Install locknuts hand tight plus 1/4 turn more.

7. Do not rely on locknuts to penetrate nonconductive coatings on boxes, enclosures and cabinets. Remove coatings in the locknut area prior to assembling conduit to ensure a continuous ground path.

8. Prevent foreign matter from entering raceways, boxes, enclosures and cabinets by using temporary closure protection.

9. Upon completion of installation of raceways, boxes, enclosures and cabinets, inspect interiors and clear all blockages and remove burrs, dirt, and construction debris.

B. Raceways:

1. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed.

2. Make bends in raceway using either large-radius preformed elbows or field bending. Use only equipment specifically designed for material and size involved. Make bends and offsets so the inside diameter is not effectively reduced.

3. Run parallel raceways together.

4. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

5. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200 pound tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

6. Do not run raceways exposed on floors.

7. Do not run raceways exposed on roofs.

8. Where raceways terminate at locations subject to moisture, provide insulating bushings to protect conductors.

9. Where terminations are subject to vibration, use bonding bushings or wedges to ensure electrical continuity.

10. Indoor Raceways:

    a. Conceal conduit within finished walls, ceilings, and floors except in equipment rooms and attics/crawl spaces, unless otherwise indicated.

    b. Do not fasten conduits onto the bottom side of a metal deck roof.

    c. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

    d. Install conduits parallel or perpendicular to building lines.

    e. Where a ceiling is scheduled to be exposed to structure, all conduit shall be secure to structure to provide a clean, organized appearance. Where routed between structural elements, install conduit as high as practical.

    f. Where conduit is installed concealed in masonry walls, transition PVC conduit within masonry wall to otherwise-specified interior or exterior raceway.

g. Terminations:

1) Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box.

2) Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

3) Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder.

4) Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

h. Stub-Ups to Above Recessed Ceilings:

1) Use EMT for raceways.

2) Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

i. Expansion Joint Fittings:

1) Install in each run of EMT conduit that is located where environmental temperature change may exceed 100°F and that has straight-run length that exceeds 100 feet.

2) Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a) Indoor Spaces Connected with Outdoors without Physical Separation: 125°F temperature change.

b) Attics: 135°F temperature change.

3) Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degree F of temperature change for metal conduits.

4) Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5) Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

11. Raceway Sealants:

    a. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

    b. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

        1) Where an underground service raceway enters a building or structure.

        2) Conduit extending from interior to exterior of building.

        3) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

        4) Where otherwise required by NFPA 70.

12. Threaded Conduit Joints, Exposed to Wet, Damp, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

13. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

C. Boxes, Enclosures and Cabinets:

1. Locations shown on Contract Drawings are approximate unless dimensioned.

2. Mount at heights indicated on Drawings. If mounting heights are not individually indicated, give priority to ADA requirements. Install with height measured to top of box unless otherwise indicated.

3. Provide support of junction and pull boxes from building structure. Do not support boxes by conduits.

4. Position recessed boxes, enclosures and cabinets to allow for surface finish thickness.

5. Mount boxes, enclosures and cabinets with fronts straight and plumb.

6. Install surface-mounted cabinets with minimum of four anchors.

7. Locate and install to allow access. Where installation is otherwise inaccessible, coordinate locations and sizes and provide required access doors.

8. Coordinate masonry cutting to achieve neat openings.

9. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

10. Locate so that cover or plate will not span different building finishes.

11. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation. Provide minimum 24 inch separation in acoustic-rated walls.

12. Coordinate mounting heights and locations of wall outlets mounted where counters, benches, and backsplashes are to be installed. Install outlets 6" above tops of counters and benches.

13. Coordinate mounting heights and locations of wall outlets where wall-mounted heating units are to be installed.

14. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

15. Mount outlet boxes for switches and receptacles with the long axis vertical unless noted otherwise. Three or more gang boxes shall be mounted with the long axis horizontal.

16. Electrically ground metallic boxes, enclosures and cabinets.

17. Where wiring to an item that includes a grounding conductor, provide a grounding terminal in the interior of the box, enclosure or cabinet.

18. Existing Outlet Boxes: Where extension rings are required to be installed, drill new mounting holes in the rings to align with the mounting holes on the existing boxes where existing holes are not aligned.

D. Surface Raceways:

1. Install surface raceways only where indicated on Drawings.

2. Install surface raceway with a minimum 2-inch radius control at bend points.

3. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

E. Installation of Access Doors:

1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

2. Adjust hardware and panels after installation for proper operation.

F. Sleeve and Sleeve Seal Installation for Electrical Penetrations:

1. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

2. Install firestopping at penetrations of fire rated floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.03 *Protection*

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to painted finishes using matching corrosion inhibiting touch-up coating recommended by the manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL INSTALLATIONS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

C. Division 07 THERMAL AND MOISTURE PROTECTION Sections.

1.02 *Summary*

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors

2. Sleeve seal systems and fittings

3. Grout

4. Sealants

5. Firestopping

6. Cable Management Pathway

1.03 *Submittals*

A. Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Product data for the following products:

a. Sealants

b. Firestopping

c. Cable Management Pathway

PART 2 PRODUCTS

2.01 *Sleeves*

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

2. Cast iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw fastening the sleeve to the board.

2.02 *Sleeve Seal Systems and Fittings*

A. Description: Provide modular mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates that cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

B. Material:

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Stainless steel.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

C. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Advance Products and Systems Inc.

2. Calpico

3. GPT Industries

4. MetraFlex

2.03 *Grout*

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.04 *Silicone Sealants*

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2. Color: As selected by the Architect from manufacturer's standard colors.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

C. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. 3M

2. Adfast

3. Dow Corning Corporation

4. GE Construction Sealants

5. Pecora Corporation

6. Rectorseal

7. Sika Corporation

8. Soudal USA

9. Tremco, Inc.

2.05 *Firestopping*

A. General:

1. Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

2. Equipment used shall be in accordance with the firestop manufacturer's written installation instructions.

3. Color: Red.

B. Performance Requirements

1. Fire Test Response Characteristics:

a. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

b. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

c. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2) FM Global in its "Building Materials Approval Guide."

C. Penetration Firestopping Systems

1. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

2. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg .

a. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

3. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

a. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.

b. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

c. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

4. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

    a. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

5. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

6. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

    a. Permanent forming/damming/backing materials.

    b. Substrate primers.

    c. Collars.

    d. Steel sleeves.

D. Fill Materials

1. Cast-in-Place Firestop Devices: Factory assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

2. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

3. Firestop Devices: Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

4. Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced intumescent elastomeric sheet bonded to galvanized steel sheet.

5. Intumescent Putties: Non-hardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

6. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

7. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

8. Pillows/Bags: Reusable heat expanding pillows/bags consisting of glass fiber cloth cases filled with a combination of mineral fiber, water insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel reinforcing wire mesh to protect pillows/bags from being easily removed.

9. Silicone Foams: Multicomponent, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

10. Silicone Sealants: Single-component, silicone based, neutral curing elastomeric sealants.

E. Mixing

1. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

F. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. 3M

2. A/D Fire Protection Systems

3. Emerson/Nelson

4. Hilti

5. Nuco Inc.

6. PFP Partners

7. RectorSeal

8. Specified Technologies Inc.

9. Tremco, Inc.

2.06 *Cable Management Pathway*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Specified Technologies Inc.

PART 3 EXECUTION

3.01 *General*

A. Contractor shall provide sleeves where raceways pass through walls, floors, and ceilings.

B. Where piping or raceways pass through waterproofed floors or walls, design of sleeves shall be such that waterproofing can be flashed into and around the sleeves.

C. Where items pass through roofs, coordinate the installation with the roofing installer and provide an approved penetration to maintain the roof warranty.

3.02 *Sleeve Installation*

A. Sleeves for Conduits Penetrating Above-Grade Concrete and Masonry Unit Floors and Walls:

1. Interior Penetrations of Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall/floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during construction of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

4. Install sleeves for floor penetrations. Extend sleeves installed in floors 6 inches above finished floor level. Install sleeves during construction of floors.

B. Sleeves for Conduits Penetrating Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

C. Roof Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

D. Aboveground, Exterior Wall Penetrations: Seal penetrations using stainless steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

E. Underground, Exterior Wall and Floor Penetrations: Install cast iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.03 *Sleeve Seal Systems and Fittings Installation*

A. Provide sleeve seal system for below-grade sleeves through exterior walls.

B. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

C. Install sleeve-seal fittings in new walls and slabs as they are constructed.

D. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates in accordance with manufacturer's recommended values to ensure that sealing grommets expand to make watertight seal.

E. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

F. Secure nailing flanges to concrete forms.

G. Using grout, seal the space around outside of sleeve seal fittings.

3.04 *Sealants*

A. General:

1. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

2. Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Preparation:

1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

a. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

b. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

c. Remove laitance and form-release agents from concrete.

d. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

2. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.05 *Firestopping*

A. General:

1. Where conduits, conduit sleeves, wireways and other electrical raceways or cables pass through fire partitions, fire walls, fire floors, or smoke walls, provide a fire or smoke stopping that provides an effective barrier against the spread of fire, smoke or gases.

2. Provide firestopping with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs.

3. Install materials in accordance with printed instructions of the UL Fire Resistance Directory and per manufacturer's published instructions.

4. All cables that are installed in conduit sleeves or in wireways through fire or smoke floors or partitions shall be provided with an equally rated re-enterable UL listed fire and smoke rated silicone RTV foam in the opening.

5. Keep areas of work accessible until inspection by applicable code authorities.

B. Preparation:

1. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

a. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.

b. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.

c. Remove laitance and form-release agents from concrete.

C. Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

D. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

E. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

F. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

G. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

H. Cable Management Pathway:

1. Application:

a. Where located in fire rated partitions, provide STI EZ-Path Fire Rated Pathway with radius control module or equal.

b. Where located in non-fire rated partitions, provide STI EZ-Path Smoke and Acoustical Pathway or equal.

c. Where installed between floors, provide STI EZ-Path Fire Rated Pathway or equal.

2. Provide pathway with appropriate rating in the following locations:

a. Minimum of one per conference room, located above door.

b. Minimum of one per private office, located above door.

c. Locations indicated on drawings

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. Section Includes:

1. Cable/Conductor Identification Bands

2. Laminated Acrylic or Melamine Plastic Labels

3. Self-Adhesive Labels

1.03 *Submittals*

A. Product Data for each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 PRODUCTS

2.01 *Electrical Identification Products*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Brady Corporation

2. Champion America

3. Emedco

4. Grafoplast

5. Hellerman Tyton

6. Ideal Industries

7. LEM Products, Inc.

8. Marketing Services, Inc.

9. Panduit

B. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

C. Cable/Conductor Identification Bands: Provide manufacturer's standard aluminum wrap-around cable/conductor markers, of size required for proper application with stamped or embossed legend, and numbered to show circuit identification.

D. Laminated Acrylic or Melamine Plastic Labels:

1. Engraved with black letters on white face, unless noted otherwise.

2. Thickness:

a. For signs up to 20 sq. in. minimum 1/16 inch thick.

b. For signs larger than 20 sq. inch, 1/8 inch thick.

3. Fasteners for Laminated Acrylic or Melamine Plastic Labels:

a. Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers. Where screws cannot or should not penetrate substrate, provide contact type permanent adhesive.

E. Self-Adhesive Labels:

1. Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

PART 3 EXECUTION

3.01 *General*

A. Install identifying devices before installing acoustical ceilings and similar concealment.

B. Verify identity of each item before installing identification products.

C. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

3.02 *Application and Installation*

A. Accessible Fittings for Raceways: Using permanent marker, identify the covers of each junction and pull box with the panelboard and circuit number(s) of installed conductors.

B. Receptacle Faceplates: Using self-adhesive labels applied to face of plate, identify panelboard and circuit number feeding device. Label shall be clear with black lettering.

C. Cable/Conductor Identification Bands: Apply cable/conductor identification bands indicating circuit number on each cable/conductor in each panelboard.

1. Apply cable identification on each voice/data cable in each rack/cabinet. Match identification with marking system used on shop drawings, contract documents, and similar previously established identification for project's work.

2. Each cable shall be marked at both ends. For local area network, each patch cable or cross connect cable shall be marked at both ends.

3. The Contractor shall review the identification scheme with the Owner prior to commencing work. The identification scheme shown on the floor plans is based on architectural room numbers and may not necessarily be the final post-construction room numbers.

D. Labels

1. General

a. Attach labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

b. Before applying self-adhesive electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

c. Apply labels to exterior of door or cover. In finished areas, install labels to inside face of doors.

d. Provide labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

e. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on minimum 1-1/2 inch high sign; where two lines of text are required, use signs minimum 2 inches high.

f. For the tele/data cabling, provide labels for each data outlet, using faceplate manufacturer's standard label holder and recommendations of TIA/EIA.

2. Warning Labels: Provide the following:

a. Workspace Clearance Warning at all panelboard locations: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

3. Equipment Identification Labels: Provide laminated acrylic or melamine plastic equipment identification labels for each device in the following categories of electrical equipment. Text shall match terminology and numbering of the Contract Documents and shop drawings.

a. Disconnect switches

b. Enclosed circuit breakers

c. Panelboards

END OF SECTION 26 05 53

SECTION 26 09 23 - LIGHTING CONTROLS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. Section includes a networked lighting control system comprised of the following components:

1. Occupancy/Vacancy Sensors

2. Digital Daylight Harvesting Dimming Control

3. Relay-Based Lighting Control

a. Wired Control Devices

4. Wallbox Timer Switches

B. The lighting control system shall meet all of the characteristics and performance requirements specified herein.

C. The contractor shall provide, install and verify proper operation of all equipment as specified herein and as shown on applicable drawings.

1.03 *Definitions*

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote control, signaling and power-limited circuits.

B. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

1.04 *Submittals*

A. Submittal shall be provided including the following items.

1. Bill of Materials necessary to install the networked lighting control system.

2. Product Data Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.

3. Riser Diagrams showing device wiring connections of typical per room/area type.

4. Other Diagrams and Operational Descriptions - as needed to indicate system operation or interaction with other system(s).

5. Example Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).

6. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.

7. Hardware and Software Operation Manuals.

1.05 *Quality Assurance*

A. Product Qualifications

1. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

2. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40°F operation.

3. All applicable products must be UL Listed or other acceptable national testing organization.

1.06 *Warranty*

A. All lighting control components shall have a five year warranty.

1.07 *Extra Materials*

A. Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, and identified with labels clearly describing contents. Deliver replacement stock directed to Owner's storage space.

1. Relay-Based Lighting Controls (Relays, Low Voltage Switches, Occupancy Sensors, Ambient Light Sensors): 1 component for every 20 of each type installed.

PART 2 PRODUCTS

2.01 *General*

A. Coordinate lighting control components to form an integrated interconnection of compatible components for optimum performance of lighting control functions.

B. Communication and low voltage power shall be delivered to each device via standard low voltage cabling as recommended by the system manufacturer.

2.02 *Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Acuity Brands/nLight
2. Cooper Lighting Solutions Wavelinx
3. Hubbell Control Solutions NX
4. Legrand/Wattstopper DLM
5. Osram/Encelium

2.03 *Occupancy/Vacancy Sensors*

A. General Requirements for Sensors:

1. Wall or ceiling mounted, suitable for mounting in any position on a standard outlet box.
2. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes; and adjustable sensitivity.
4. All sensors shall have an LED to indicate occupant detection.
5. In case of device failure, sensor shall fail to the 'on' position.
6. All sensors shall operate with all LED lamp and driver combinations.

B. Dual-Technology Type: Detect occupants in coverage area using ultrasonic/microphonic and PIR detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Ceiling mounted:
   a. Sensitivity Adjustment: Separate for each sensing technology.
   b. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/sec.

c. Detection Coverage: Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on an 8' high ceiling.

2. Wall box mounted:

a. Sensor shall have a minimum 170 degree radial spread pattern with a minimum of 20 feet axial sensor coverage.

b. Sensor shall incorporate temperature compensated dual element sensor and multi element fresnel lens.

c. Sensor shall have a daylight filter to ensure the sensor is insensitive to short-wavelengths emitted by the sun.

d. Device shall be completely self contained to replace standard toggle switches.

e. Device shall be user adjustable for normal operation.

f. Device shall control lighting using momentary switch operation.

2.04 *Digital Daylight Harvesting Dimming Controls*

A. Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, lights are dimmed.

1. Lighting control set point is based on the following two lighting conditions:

a. When no daylight is present (target level).

b. When significant daylight is present.

2. System programming is done with two hand-held, remote-control tools.

a. Initial setup tool.

b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

B. Ceiling Mounted Dimming Controls: Solid-state, light-level sensor unit to detect changes in indoor lighting levels that are perceived by the eye.

C. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Sensor Output: 0- to 10-V dc to operate luminaires. Sensor is powered by controller unit.

3. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc.

2.05 *Relay Based Lighting Control*

A. Summary

1. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.

2. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed).

3. All system devices shall be networked together enabling digital communication and shall be individually addressable.

4. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.

5. The system architecture shall allow for remote operation via a computer connection.

6. The system shall not require any centrally hardwired switching equipment.

7. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.

B. System Performance Requirements

1. System Architecture

a. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) system backbone for remote, time based and global operation between control zones. This installation will not require the devices to be networked together at this time, but have the ability to be networked in the future.

b. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.

c. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone.

d. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as "distributed intelligence."

e. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.

f. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.

g. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.

2. Supported Sequence of Operations

a. Characteristics and performance requirements herein shall be supported by the networked lighting control system.

b. Control Zones

1) Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as 'local control zones'.

2) Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as 'global control zones'. This control shall be part of future building wide networked controls.

c. Wall station Capabilities

1) Wall stations shall be provided to support the following capabilities:

a) On/Off of a local control zone and global control zone

simultaneously, as required.

b) Continuous dimming control of light level of a local control zone and global control zone simultaneously, as required.

c) Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.

d) Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting "Local Profiles" and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

2) Multiple wall stations shall be capable of controlling the same local and global control zones, so as to support "multi-way" switching, dimming, preset scene, and profile scene control.

d. Occupancy Sensing Capabilities

1) Occupancy sensors shall be configurable to control a local and global zone simultaneously, as required.

2) Multiple occupancy sensors shall be capable of controlling the same local and global control zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.

3) System shall support the following types of occupancy sensing sequence of operations:

a) On/Off Occupancy Sensing

b) Partial-On Occupancy Sensing

c) Partial-Off Occupancy Sensing

d) Vacancy Sensing (Manual-On / Automatic-Off)

4) On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:

a) Occupancy sensors shall automatically turn lights on to a designated

level when occupancy is detected.

b) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected.

c) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage.

d) At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

5) Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:

a) The use of a wall station is required to turn lights on. The system shall be capable of programming the zone to turn on to either to a designated light level or the previous user light level. Initially occupying the space without using a wall station shall not result in lights turning on.

b) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected.

c) To minimize occupant impact in case the area or zone is still physically occupied following dimming or shutoff of the lights due to detection of vacancy, the system shall support an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.

d) At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

6) To accommodate different types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.

e. Photocell Sensing Capabilities (Automatic Daylight Sensing)

1) Photocell sensing devices shall be configurable to control a local and global zone simultaneously, as required.

2) The system shall support the following types of photocell-based control:

a) On/Off: The control zone is automatically turned off if the photocell reading exceeds the defined setpoint and automatically turned on if the photocell reading is below the defined setpoint. An adjustable time delay or adaptive setpoint behavior may be used to prevent the system from exhibiting nuisance on/off switching, as well as a dead band to prevent on/off cycling.

b) Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.

C. Wired Networked Devices

1. Wall Switches, Dimmers, Scene Controllers

a. Devices shall recess into single-gang switch box and fit a standard GFI opening.

b. Devices with mechanical pushbuttons shall provide tactile and LED user feedback.

c. Devices with mechanical pushbuttons shall be furnished with custom button labeling.

d. Supply faceplates per specification Section 26 27 26 “Wiring Devices”.

2. Relay Packs

a. Relay Packs shall accept 120 or 277 VAC and carry a plenum rating.

b. Power Supplies shall provide system power only, but are not required to switch line voltage circuit.

c. Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).

d. Relay Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.

e. Relay Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through

chase nipple into adjacent junction box without any exposure of wire leads.

f. Types of Relay Packs

1) Standard Relay Pack: Capable of full 16-Amp switching of all normal power lighting load types.

2) Dimming Relay Pack: Capable of full 16-Amp switching of all normal power lighting load types, and 0-10V dimming output capable of up to 100mA of sink current.

3) Power Supply capable of providing auxiliary bus power (no switched or dimmed load).

2.06 *Wall box Timer Switch*

A. Solid state, programmable, with alphanumeric display or preset, multi-button configuration; complying with UL 917.

2.07 *Cabling*

A. Provide all low voltage cabling as recommended by system manufacturer. Cable shall be plenum rated.

PART 3 EXECUTION

3.01 *Installation*

A. Inspection:

1. Inspect each installed device for damage. Replace damaged devices and components.

2. Review architectural drawings for ceiling construction where applicable and verify details with ceiling installer. Provide hardware and additional supporting devices as necessary to install devices in each area.

B. Project Conditions:

1. Only install equipment after the following site conditions are maintained:

a. Ambient Temperature: 14° to 105°F.

b. Relative Humidity: less than 90% non-condensing

2. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above, at any point prior to installation.

3. Only properly rated equipment and enclosures, installed per the manufacturer's instructions, may be subjected to dust and moisture following installation.

C. General:

1. Install wiring above accessible ceilings. Support cabling from structure every 5'-0" minimum.

2. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power limited and non-power limited conductors according to conductor manufacturer's written instructions.

3. Install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.

4. Mount each relay directly to junction box above the ceiling near the location of the associated low voltage switch (where applicable). Conduit shall terminate within 6" of relay. Provide bushing on end of conduit. Low voltage cable may be coiled, a maximum of 5' of length, between the conduit termination and the sensor.

5. Where four or more relay packs are grouped together in one location, mount relays to a 6" x 6" x 4" deep junction box above accessible ceiling.

3.02 *Coordination*

A. Review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.

3.03 *System Startup*

A. Test all field terminated low voltage control cable prior to system start-up. Pre-terminated cables to be tested at factory.

B. Upon completion of installation, system startup shall be performed by qualified personnel approved or certified by the manufacturer.

C. Verify operational communication to all system devices.

D. Program the network devices into functional control zones to meet the required sequence of operation.

E. Initial start-up and programming is to occur on-site. Additional programming may occur on-site as necessary.

3.04 *Field Quality Control*

A. Clean devices upon completion of installation. Use methods and materials recommended by manufacturer. Devices with dust, dirt, scratches, or fingerprints shall not be acceptable.

B. The Contractor shall be responsible for final adjustment and testing of all devices.

C. Manufacturer's Field Service: Engage a factory authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

D. Perform the following tests after devices have been installed, circuits energized, and system start-up is complete:

1. Test for circuit continuity.

2. Verify operation of local override controls.

3. Test sensitivity of each device per manufacturer's recommendations.

4. Verify that dimmers function without producing lamp flicker and without interference with audio and visual equipment.

E. Replace or repair malfunctioning devices and components, then retest. Repeat procedure until all units operate properly.

3.05 *Demonstration and Training*

A. Provide onsite meeting with owner, engineer, and qualified technician approved or certified by the manufacturer to verify all system programming preferences.

B. Provide eight hours of onsite training for owner and designated personnel by qualified technician approved or certified by the manufacturer. Personnel to be trained to adjust, operate, and maintain lighting controls.

3.06 *Project Close-Out*

A. As-built Drawings: Document installed location of all networked devices.

B. Provide the following additional documentation to the manufacturer's representative:

1. As-Built floor plan drawings showing daisy chain wired network control zones outlined, in addition to device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic.

2. As-Built electrical lighting drawings in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.

C. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to four visits to site during other-than-normal occupancy hours for this purpose.

D. Provide owner with updated as-built drawings, including device/equipment addresses, locations, etc.

END OF SECTION 26 09 23

SECTION 26 24 13 - SWITCHBOARDS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. Section Includes:

1. Disconnecting and overcurrent protective devices.

1.03 *Submittals*

A. Product Data: For each overcurrent protective device, accessory, and component, include:

1. Dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Maintenance Manuals: In addition to requirements specified in Division 01 and 26, include the following:

1. Manufacturer’s written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.04 *Quality Assurance*

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E. Firm with at least 5 years of successful installation experience on projects utilizing switchboards similar to those required for this project.

1.05 *Warranty*

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace overcurrent protective devices and accessories that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 *Acceptable Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide overcurrent protective devices of the following manufacturer to match existing equipment:

1. Schneider Electric/Square D

2.02 *General*

A. Obtain overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Front-Connected, Front-Accessible Switchboards:

1. Branch Devices: Panel mounted.

C. Nominal System Voltage: Voltage as indicated on drawings.

2.03 *Circuit Breakers*

A. Feeder Circuit Breakers:

1. Protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping.

2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

3. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.

4. Where indicated circuit breakers shall be current limiting.

5. Where indicated provide UL listed circuit breakers for applications at 100% of their continuous ampere rating in their intended enclosure.

6. Where indicated circuit breakers shall be UL listed for series application.

7. Unless indicated otherwise, circuit breakers 800A frame and below shall have thermal-magnetic trip units and inverse time-current characteristics.

PART 3 EXECUTION

3.01 *Inspection*

A. Installer must examine areas and conditions under which switchboards and components are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 *Installation*

A. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.

B. Contractor is responsible for wiring, including providing all necessary cable, conduit, hangers, etc., for connecting the new switchboard metering and any necessary alarm statuses into the existing University E-Meter system.

3.03 *Labeling*

A. Provide an engraved label for each breaker in the switchboard. Each label be formatted as follows:

IDENTIFICATION OF LOAD BY EQUIPMENT TAG
CURRENT RATING/NUMBER OF POLES

3.04 *Adjusting and Cleaning*

A. Adjust operating mechanisms for free mechanical movement.

3.05 *Grounding*

A. Provide equipment grounding connections for switchboards as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

3.06 *Field Quality Control*

A. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.

B. Prior to energization of switchboard, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

C. Prior to energization, check switchboards for electrical continuity of circuits, and for short-circuits.

D. Subsequent to wire and cable hook-ups, energize switchboard and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

E. Testing Agency: Engage a qualified independent testing agency to perform specified testing.

F. Testing: After installing switchboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.6 for all circuit breakers 200 amps and larger. Certify compliance with test parameters.

END OF SECTION 26 24 13

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600V and less for the following types:

1. Distribution panelboards.

2. Lighting and appliance branch-circuit panelboards.

3. Load centers.

1.03 *Definitions*

A. EMI: Electromagnetic interference.

B. GFCI: Ground fault circuit interrupter.

C. GFEP: Ground fault equipment protection.

D. ICS: Industrial Control Systems

E. MCOV: Maximum continuous operating voltage.

F. RFI: Radio frequency interference.

1.04 *Submittals*

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated, include:

1. Dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard, include:

1. Dimensioned plans, elevations, sections, and details.

2. Enclosure types and details for types other than NEMA 250, Type 1.

3. Bus configuration, and current, and voltage ratings.

4. Short circuit current rating of panelboards and overcurrent protective devices.

5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.

C. Maintenance Manuals: In addition to requirements specified in Division 01 and 26, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

D. Layout Drawings: Prepare layout drawing for each room or area of the building containing panelboards and submit for review at the time of the equipment submittal. Layout drawings shall be based on actual submitted equipment dimensions. Indicate working clearances for each panelboard.

1.05 *Quality Assurance*

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E. Firm with at least 5 years of successful installation experience on projects utilizing panelboards similar to those required for this project.

1.06 *Delivery, Storage, and Handling*

A. Do not deliver panelboard interiors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Remove loose packing and flammable materials from inside panelboards.

1.07 *Coordination*

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.08 *Warranty*

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed

interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protective devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.09 *Extra Materials*

A. Keys: Furnish six spares of each type for panelboard cabinet locks.

B. Touch-up Paint: For surface mounted panelboards - one half-pint container.

PART 2 PRODUCTS

2.01 *Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide panelboards of the following manufacturer:

1. Eaton

2. GE by ABB

3. Schneider Electric/Square D

4. Siemens Industry, Inc.

2.02 *General*

A. Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Refer to Panelboard Schedules on drawings for additional panelboard requirements, including but not limited to, mains type and size, mounting, branch circuit breaker sizes and quantities, SCCR rating, options, etc.

C. Enclosures:

1. Provide flush and surface mounted enclosures as indicated on the drawings.

2. Standard panel dimensions: 6" deep x 20" wide x 84" high (maximum height).

a. Provide 6" auxiliary gutter on all panelboards scheduled with more than 54 pole spaces/branch circuit breakers.

3. Rated for environmental conditions at installed locations:

    a. Indoor Dry Locations: Steel, Type 1

4. Backbox Finish:

    a. Flush mounted cabinets: Galvanized steel.

    b. Surface mounted cabinets: Same finish as panel cover.

D. Incoming Mains:

1. Main breaker or main lugs as indicated on drawings.

2. Location shall be convertible between top and bottom.

3. Main lug interiors shall be field convertible to main breaker.

E. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

    a. Plating shall run entire length of bus.

    b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.

3. All bus work shall be rated to withstand short circuit stresses at specified voltage as described on the panelboard schedules shown on the drawings.

4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

5. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

F. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Terminations shall allow use of 75°C rated conductors without derating.

3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.

4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.

5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

6. Feed-Through Lugs (where indicated on drawings): Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

G. Panelboard Short-Circuit Current (SCCR) Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals. Panelboards with a Series Short Circuit Rating are not acceptable.

2. Assembly shall be UL listed for 100 percent interrupting capacity.

3. Minimum short circuit current rating of panelboard shall be as specified on the panelboard schedules shown on the drawings. No device within panelboard shall be lower than this rating.

H. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.

2.03 *Lighting and Appliance Branch Circuit Panelboards*

A. NEMA PB 1, lighting and appliance branch-circuit type.

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

C. Doors/Covers:

1. Hinged Front Cover: Door-in-door construction with concealed hinges. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.EZ Trim as manufactured by Eaton is not acceptable.

2. Secured with flush latch with tumbler lock; keyed alike.

a. For doors more than 36 inches high, provide two latches, keyed alike.

3. Finish:

a. Indoor Dry Locations: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

2.04 *Load Centers*

A. Overcurrent Protective Devices: Plug-in, full-module circuit breaker, replaceable without disturbing adjacent units.

B. Doors/Covers:

1. Concealed hinges secured with flush latch with tumbler lock; keyed alike.

2. Finish:

a. Indoor Dry Locations: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

b. Outdoor and other Wet Locations: Steel, Type 3R, Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.

2.05 *Overcurrent Protective Devices*

A. Molded Case Circuit Breaker (MCCB) with interrupting capacity to meet available fault currents.

1. General

a. Circuit breakers shall have quick-make, quick-break operating mechanisms and silver alloy contacts.

b. The operating handle shall indicate ON, TRIPPED, and OFF positions.

c. Multi-pole units enclosed in a factory assembled to operate as a single unit.

d. Circuit breakers shall be electrically and mechanically trip free.

e. Circuit breakers shall be UL489 listed.

f. Circuit breakers and terminals shall have a UL 60/75°C rating.

g. UL listed for reverse connection without restrictive line or load ratings.

h. Tandem circuit breakers shall not be used.

i. Mechanical style lugs, suitable for number, size, trip ratings, and material of conductors.

j. Three-pole breakers with ampere ratings greater than 250 amperes shall have interchangeable rating plugs or electronic adjustable trip units.

k. Unless indicated otherwise, circuit breakers 800A frame and below shall have thermal-magnetic trip units and inverse time-current characteristics.

2. Thermal Magnetic Circuit Breakers:

   a. Inverse time-current element for low-level overloads.

   b. Instantaneous magnetic trip element for short circuits.

   c. Adjustable Trip Circuit Breakers:

      1) Provide adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

      2) Field-adjustable trip settings for magnetic trip element shall be front-mounted.

3. Molded Case Circuit Breaker Options and Accessories:

   a. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position for circuit(s) feeding fire alarm control and extender panel(s).

   b. Subfeed Circuit Breakers: Vertically mounted.

   c. GFCI Circuit Breakers: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

   d. GFEP Circuit Breakers: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Class B ground-fault protection (30-mA trip).

2.06 *Panelboard Options*

A. Integral Surge Protective Device (SPD)

1. UL 1449, Type 2 SPD (Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device).

2. Factory installed integral to electrical distribution equipment.

3. Direct bussed connected or breaker fed.

4. UL labeled with 200kA Short Circuit Current Rating (SCCR).

5. UL labeled with 20kA I-nominal (I-n) (verifiable at UL.com).

6. Protection modes shall be as follows: Line to Neutral, Line to Ground, and Neutral to Ground.

7. Minimum single-impulse current rating shall be as follows:

   a. Line to Neutral: 160,000 A.

   b. Line to Ground: 160,000 A.

   c. Neutral to Ground: 160,000 A.

8. UL 1449 Voltage Protection Ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-G	L-L	MCOV
208Y/120	700V	700V	700V	1200V	150V

9. EMI/RFI Noise Attenuation using 50 Ohm insertion loss test: 55 dB at 100 kHz.

10. The protection status of every surge protective element shall monitored including elements connected across neutral to ground. Diagnostics shall change state if any surge protective element reaches end of life.

11. SPD shall be equipped with the following diagnostics:

    a. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.

    b. Audible alarm with on/off silence function and diagnostic test function (excluding branch).

    c. Form C dry contacts

12. SPD shall have a 10 year warranty.

2.07 *Identification*

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated circuit directory card inside panelboard door, mounted in metal frame with transparent protective cover. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Existing Panelboard Circuit Directory: Where circuiting in existing panelboards has been revised (added and/or eliminated), provide an updated, computer-generated circuit directory card inside panelboard door, mounted in metal frame with transparent protective cover. Circuit directory shall identify specific purpose with detail sufficient to

distinguish it from all other circuits. Circuit directory shall incorporate existing loads and new loads.

PART 3 EXECUTION

3.01 *Examination*

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 *Installation*

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Mounting:

1. Panelboards shall be installed such that the center of the grip of the operating handle of any overcurrent devices (switch or circuit breaker) located in the panelboard, when in its highest position, is not more than 6'-7" above finished floor or working platform.

2. Mount panelboard cabinet plumb and rigid without distortion of box.

3. Mount panelboards with minimum of four anchors.

4. Mount surface mounted panelboards to steel slotted supports 1-5/8 inch in depth. Orient steel slotted supports vertically.

5. Mount flush mounted panelboards with fronts uniformly flush with wall finish and mating with back box.

6. Install flush mounted panelboards with an overlapping trim set tight to the wall surface.

7. Use sheet metal channel to bridge studs above and below panelboards recessed in hollow partitions.

C. Maintain required workspace clearances per NEC 110.26.

D. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

E. Make grounding connections and bond neutral for services and separately derived systems to ground.

F. Install filler plates in unused spaces.

G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits below floor deck (where applicable).

H. Wiring in Panel Gutters: Arrange conductors neatly in groups and bundle and wrap with wire ties after completion of load balancing.

I. Install Handle Clamp(s) on circuit breaker(s) feeding fire alarm control and extender panel(s).

J. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.03 *Identification*

A. Identify field installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section 26 05 53 "Identification for Electrical Systems."

B. Panelboard Directory:

1. Create a directory to indicate installed circuit loads.

2. All panelboard directories shall reflect the as built electrical configuration of the job, including the approved changes required to balance the panel loads.

3. Each directory entry shall include a description of the connected load(s) and the room number, which corresponds to the location(s) of the connected loads.

4. Incorporate Owner's final room designations.

5. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

6. Obtain approval before installing.

7. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate in accordance with Nameplate Detail - Panelboards shown on the drawings.

D. Distribution Panelboard Device Nameplates: Label each branch circuit device in Distribution Panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.04 *Field Quality Control*

A. Inspect for defects and physical damage.

B. Check panelboard mounting, area clearances, and fit of components.

C. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

D. Test continuity of each circuit.

E. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

F. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

G. For circuit breakers 200 amps and larger, perform each visual inspection, mechanical inspection, and electrical test indicated in NETA ATS, Section 7.6. Engage a qualified independent testing agency to perform specified testing and certify compliance with test parameters.

3.05 *Adjusting*

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

5. Make changes to color-coded phase wires as required to reflect installed condition.

3.06 *Cleaning*

A. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems that are intended to carry, but not utilize, electric energy.

B. This Section includes the following:

1. Receptacles:

a. Standard receptacles

b. GFCI receptacles

c. Weather-resistant GFCI receptacles

d. Tamper-resistant receptacles

e. Tamper-resistant GFCI receptacles

f. USB charging receptacles

g. Twist-locking receptacles

2. Fabricated Wiring Assemblies:

a. Poke-through assemblies

b. Telephone/power service poles

3. Wiring device accessories

1.03 *Definitions*

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. SPD: Surge protective device.

1.04 *Submittals*

A. Product data: Submit manufacturer's data for each type of product specified.

PART 2 PRODUCTS

2.01 *General Wiring Device Requirements*

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with the following:

1. NEMA WD 1 and WD 6.

2. NFPA 70.

3. RoHS.

4. UL 498.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.

2. Devices shall comply with requirements in this Section.

D. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

E. Device Color:

1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.

2. Devices installed in surface raceways shall match the raceway color.

3. The Contractor shall verify color selections with the Architect and Owner prior to ordering any devices.

F. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 *Receptacles*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Eaton Wiring Devices/Arrow Hart

2. Hubbell

3. Legrand/Pass & Seymour

4. Leviton

B. Standard Receptacles:

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.

C. Ground Fault Current Interrupter (GFCI) Receptacles:

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.

2. Provide GFCI-type device. Device shall include indicator light that is lighted when device is tripped. Device shall conduct an automatic test every three seconds, ensuring ground fault protection. If protection is lost, power to the unit is disconnected and indicator light flashes indicating that the unit should be replaced. Device shall be designed for installation in a 2-3/4 inch deep outlet box without an adapter.

D. Weather Resistant GFCI Receptacles:

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.

2. Listed and labeled as complying with NFPA 70 "Receptacles in Damp or Wet Locations" article.

3. Provide GFCI-type device. Device shall include indicator light that is lighted when device is tripped. Device shall conduct an automatic test every three seconds,

ensuring ground fault protection. If protection is lost, power to the unit is disconnected and indicator light flashes indicating that the unit should be replaced. Device shall be designed for installation in a 2-3/4 inch deep outlet box without an adapter.

4. Receptacle shall have internal locking shutter mechanism that opens when the two receptacle blade slots are penetrated simultaneously or receptacle requires the presence of an object in both right and left contacts to energize the device. Receptacle shall be listed to UL and federal specification WC596-F.

E. Tamper-Resistant Receptacles:

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.

2. Receptacle shall have internal locking shutter mechanism that opens when the two receptacle blade slots are penetrated simultaneously or receptacle requires the presence of an object in both right and left contacts to energize the device. Receptacle shall be listed to UL and federal specification WC596-F.

F. Tamper-Resistant GFCI Receptacles,

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.

2. Receptacle shall have internal locking shutter mechanism that opens when the two receptacle blade slots are penetrated simultaneously or receptacle requires the presence of an object in both right and left contacts to energize the device. Receptacle shall be listed to UL and federal specification WC596-F.

3. Provide GFCI-type device. Device shall include indicator light that is lighted when device is tripped. Device shall conduct an automatic test every three seconds, ensuring ground fault protection. If protection is lost, power to the unit is disconnected and indicator light flashes indicating that the unit should be replaced. Device shall be designed for installation in a 2-3/4 inch deep outlet box without an adapter.

G. USB Charging Receptacles:

1. Provide two pole, three wire, self-grounding, specification grade, heavy duty, 125V, 20A, NEMA Type 5-20R, back and side wired, with green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and wrap around bridge for installation strength.

2. USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).

3. Provide combination device with two NEMA type 5-20R and two USB charging outlets.

4. Provide device with two USB charging outlets.

5. Provide device with four USB charging outlets.

H. Twist-Locking Receptacles

1. NEMA configurations as indicated on drawings.

2.03 *Fabricated Wiring Assemblies*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Hubbell

2. Legrand/Wiremold

B. General:

1. All devices, mounting plates, etc. shall be manufactured by single source.

2. Provide gang quantity and configuration as indicated on drawings.

3. Provide quantity and type of individual devices mounted in assembly as described on drawings. Each individual device shall meet the requirements of the respective specification section.

4. Provide device mounting and face plates as required to accommodate devices.

C. Poke-Through Assembly Devices:

1. Factory fabricated and wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.

2. Provide integral assembly UL listed as a total unit, with fire rating consistent with that of floor penetrated.

3. Selected to fit cored holes in floor and matched to floor thickness.

4. Provide separation barrier between power and low-voltage section.

5. Provide die-cast metal cover as described on drawings. Coordinate cover type and finish with architect.

D. Telephone/Power Service Poles:

1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.

2. Nominal 2.5-inch- square cross-section aluminum, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.

3. Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.

2.04 *Wiring Device Accessories*

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Eaton Wiring Devices/Arrow Hart

2. Hubbell

3. Legrand/Pass & Seymour

4. Leviton

B. Wall plates for use in interior, dry locations: single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide .04 inch thick, Type 302 brushed stainless steel flush cover plates.

C. Wall plates for use in interior, dry locations with surface-mounted devices in unfinished areas: Raised galvanized steel with rounded corners.

D. Wall plates for use in damp or wet locations:

1. Weatherproof, extra-duty, while-in-use type with gasketed, clear polycarbonate cover and lockable tab.

2. Weatherproof gasketed die-cast aluminum cover.

E. Blank cover plates shall match adjacent device plates.

PART 3 EXECUTION

3.01 *Installation*

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

   a. Cut back and pigtail, or replace all damaged conductors.

   b. Straighten conductors that remain and remove corrosion and foreign matter.

   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Protection

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

3. Protect installed components from damage.

4. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

E. Device Installation:

1. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

2. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

3. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

4. Use a torque screwdriver when a torque is recommended or required by the manufacturer.

5. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.

6. Tighten unused terminal screws on the device.

7. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

8. Unless otherwise indicated, mount flush, with long dimension vertical.

9. Install receptacles vertically, with ground pin located at the top. Where horizontal mounting is required due to space constraints, install receptacle with neutral blade located at the top.

10. Group adjacent devices under single, multi-gang wall plates.

F. Adjust locations of fabricated wiring assemblies to suit arrangement of partitions and furnishings.

G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.02 *Field Quality Control*

A. Tests for Convenience Receptacles:

1. Diagnostic testing: Use a digital wiring analyzer with digital readout or illuminated LED indicators of measurement complying with UL 1436. Perform the followings diagnostic tests, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems.

a. Line Voltage: Acceptable range is 105 to 132 V.

b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

c. Ground Impedance: Values of up to 2 ohms are acceptable.

d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

2. Using the test plug, verify that the device and its outlet box are securely mounted.

B. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. This Section includes cartridge fuses, rated 600 V and less, for use in switches and controllers.

1.03 *Submittals*

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

B. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

2. Let-through current curves for fuses with current limiting characteristics.

3. Time current curves, coordination charts and tables, and related data.

C. Ambient Temperature Adjustment Information. If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses adjusted.

1. For each adjusted fuse, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.

2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

D. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 01.

1.04 *Quality Assurance*

A. Source Limitations: Provide fuses from a single manufacturer.

B. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

C. ANSI Compliance: Comply with applicable requirements of ANSI C97 "Low Voltage Cartridge Fuses 600 Volts or Less".

D. UL Listing and Labeling: Items provided under this Section shall be listed and labeled by UL.

E. Comply with NEMA FU 1.

F. Nationally Recognized Testing Laboratory Listing and Labeling (NRTL): Items provided under this Section shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

1.05 *Project Conditions*

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.06 *Coordination*

A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

1.07 *Extra Materials*

A. Maintenance stock - fuses: For types and ratings required, furnish spare fuses, amounting to one unit for every five installed units, but not less than one set of three of each kind.

B. Provide three fuse pullers.

PART 2 PRODUCTS

2.01 *Manufacturers*

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Bussmann Division, Cooper Industries, Inc.

2. Shawmut Division; Gould Inc.

3. Littlefuse, Inc.

2.02 *Fuses - General*

A. General: Provide fuses of types, classes, and current ratings as indicated. Voltage ratings shall be consistent with the circuits on which used.

2.03 *Cartridge Fuses*

A. General: Comply with ANSI/IEEE Standard FU1, "Low Voltage Cartridge Fuses." Provide nonrenewable cartridge type fuses.

1. Fuses shall be all of the same manufacturer.

2. Class RK1 Dual Element Time Delay Fuses: Comply with UL 198E, "Class R Fuses."

PART 3 EXECUTION

3.01 *Examination*

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 *Application Of Fuses*

A. Fusible Switches: Apply the following class and types:

1. 30-600 Amperes: Class RK1, time delay.

B. Combination Starters: Class RK1, time delay.

3.03 *Installation*

A. Provide fuses in all fuse gaps of all equipment provided under this Contract.

B. Install fuse so that ratings are readable without removing fuse.

C. Fuses shall not be installed until equipment is ready to be energized.

3.04 *Field Quality Control*

A. Prior to energization of fusible devices, test devices for continuity of circuitry and for short-circuits. Replace malfunctioning units with new units, and then demonstrate compliance with requirements.

3.05 *Identification*

A. Install labels indicating fuse replacement information on inside door of each fusible device.

END OF SECTION 26 28 13

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. This Section includes circuit and motor disconnects.

B. Extent of circuit and motor disconnect switch work is indicated by drawings and schedules.

C. Types of circuit and motor disconnect switches in this section include the following:

1. Equipment disconnects

2. Appliance disconnects

3. Motor circuit disconnects

4. Contactors

D. Wires/cables, raceways, and electrical boxes and fittings required in connection with circuit and motor disconnect work are specified in other Division 26 sections.

1.03 *Submittals*

A. Product Data: For each type of switch, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Maintenance data for circuit and motor disconnects, for inclusion in Operation and Maintenance Manual specified in Division 01 and Division 26 Section 26 01 00 “Basic Electrical Requirements”.

C. Shop Drawings: Submit shop drawings of electrical circuit and motor disconnect switches showing accurately scaled switches, their layouts, and proximity to associated equipment.

D. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

1. Enclosure types and details for types other than NEMA 250, Type 1.

2. Current and voltage ratings.

3. Short circuit current rating.

4. UL listing for series rating of installed devices.

5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

E. Maintenance Data: For enclosed switches and components to include in maintenance manuals specified in Division 01. In addition to requirements specified in Division 01 Section "Closeout Procedures," include the following:

1. Routine maintenance requirements for components.

2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.

3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.04 *Quality Assurance*

A. Manufacturers: Firms regularly engaged in manufacture of circuit and motor disconnect switches of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing circuit and motor disconnect work similar to that required for this project.

C. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.

D. UL Compliance: Comply with requirements of UL98, "Enclosed and Dead Front Switches". Provide circuit and motor disconnect switches that have been UL listed and labeled.

E. UL Compliance: Comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials that are UL-listed and labeled.

F. NEMA Compliance: Comply with applicable requirements of NEMA Standards Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical Equipment (1000 volts maximum).

G. Product Selection for Restricted Space: Drawings indicate the location where enclosed switches are to be installed. Verify the suitability for installation in this location, including clearances between enclosures, and adjacent surfaces and other items.

PART 2 PRODUCTS

2.01 *Manufacturers*

A. Subject to compliance with requirements, provide circuit and motor disconnects of one of the following:

1. Square D Company

2. Eaton Corporation

3. General Electric Company

4. Siemens

2.02 *Fabricated Switches*

A. Heavy Duty Safety Switches:

1. Provide surface mounted, heavy duty type, sheet steel enclosed safety switches of types, sizes and electrical characteristics indicated on the drawings.

2. Provide switches with quick-make, quick-break type operation, with switchblades that are visible in the 'OFF' position with door open.

3. Operating handle shall be an integral part of the enclosure base the operating position shall be easily recognizable and pad-lockable in OFF position.

4. Current carrying parts shall be constructed of 98% conductivity copper, with silver-tungsten type switch contacts and positive pressure type reinforced fuse clips.

5. Provide disconnect switches having the capability to have auxiliary contacts mounted as required.

B. Fusible Switches: Heavy duty safety switches as described above, with positive pressure type reinforced fuse clips and fuses of classes and current ratings indicated. See Division 26 Section FUSES for specifications. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.

C. Manual motor starters:

1. Toggle type manual motor starter having low voltage protection, surface mounted in a NEMA 1 enclosure, Square D Class 2510 where indicated on the drawings.

2. Where motor switches are located remote or out of sight from equipment controlled, switch shall be provided with an approved neon pilot light.

3. Provide motor and motor starter disconnects with horsepower ratings suitable to the loads.

D. Enclosures shall meet environmental conditions of installed location.

1. Indoor Locations: NEMA 250, Type 1

2. Outdoor Locations: NEMA 250, Type 3R.

E. Finish shall be manufacturer's standard gray finish unless otherwise noted on drawings.

PART 3 EXECUTION

3.01 *Installation of Circuit and Motor Disconnects*

A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and NECA's "Standard of Installation" and in accordance with recognized industry practices.

C. Coordinate circuit and motor disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

D. Install disconnect switches for use with motor driven appliances, and motors and controllers within sight of the controller position unless otherwise indicated.

E. Coordinate layout and installation of switches and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

F. Install power wiring. Install wiring between switches and control, and indication devices.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

H. Where the motor is located out of sight or more than 50 feet from its circuit breaker (or combination starter) this Contractor shall provide a properly rated motor circuit switch at the motor location in accordance with the CIRCUIT AND MOTOR DISCONNECT section of this Specification.

1. Exceptions:

a. Where equipment is furnished complete with an approved integral disconnect.

3.02 *Neutral Bar*

A. When a neutral conductor is required for the load connected to a safety switch, the Contractor shall provide a copper neutral bar in the safety switch. This copper neutral

bar shall be furnished by the manufacturer of the disconnect switch and shall be designed to be installed within the particular disconnect switch installed.

3.03 *Grounding*

A. Install equipment grounding connections for switches with ground continuity to main electrical ground bus.

B. Provide an equipment grounding kit with all disconnect switches.

C. Connections shall be tightened in accordance with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors".

3.04 *Field Quality Control*

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, component, and control circuit.

2. Test continuity of each line and load-side circuit.

B. Testing Agency: The Contractor shall perform the following testing or engage a qualified independent testing agency to perform testing.

C. Testing: After installing enclosed switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches 200 amps and larger. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.05 *Cleaning*

A. Upon completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 28 16

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. This Section includes the following:

1. Interior lighting fixtures.

2. Exit signs.

3. Emergency lighting units.

1.03 *Definitions*

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 *Submittals*

A. Product Data: For each type of product.

1. Arrange in order of fixture designation.

2. Include data on features, accessories, and finishes.

3. Include physical description and dimensions of fixtures.

4. Include installation and attachment details.

5. Include emergency lighting units, including batteries and chargers.

6. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.

7. Include "Lighting Facts".

8. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the fixture as applied in this Project.

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.05 *Quality Assurance*

A. Luminaire Photometric Data Testing Laboratory Qualifications: Fixture manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Each fixture type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among fixtures.

C. Fixtures must meet the following:

1. LM-79: Approved Method for Electrical and Photometric Measurement of SSL Products

2. LM-80: Approved Method for Measuring Lumen Maintenance of LED Light Sources

3. L-70: 70% Lumen Maintenance

4. TM-21: Establishes a method for projecting lumen maintenance (and useful lifetime) of LED light sources from available LM-80 data

1.06 *Delivery, Storage, and Handling*

A. Deliver lighting fixtures and accessories in factory fabricated containers or wrappings that properly protect fixtures from debris and physical damage.

B. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.

C. Store lighting fixtures in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

1.07 *Warranty*

A. Manufacturer and Installer agree to repair or replace components of fixtures that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 *Lighting Fixtures*

A. Manufacturers

1. Provide lighting fixtures of types described on the drawings under the 'LIGHTING FIXTURE SCHEDULE'.

2. Provide lighting fixtures complete with, but not limited to, housings, drivers, and wiring.

3. Manufacturer and product series are indicated in the 'LIGHTING FIXTURE SCHEDULE' and constitute the type and quality of fixture to be provided. All published specifications of the manufacturer that correspond to the indicated catalog number, shall be considered as part of this specification even though they may not be shown in complete detail.

4. Manufacturer's product series indicate the general line of fixtures required and may not necessarily include all prefixes and suffixes for options, trim and/or configurations required.

5. Bid prices shall be based on information in all columns of the 'LIGHTING FIXTURE SCHEDULE'.

6. Where a conflict exists between the fixture description and the manufacturer's product series, the price shall include the more expensive option. Coordinate conflicts with engineer prior to submitting bid.

7. The listing of a manufacturer does not guarantee that manufacturer will have a product that meets the requirements put forth in the fixture description. Approval of specific fixtures by an approved manufacturer will be subject to review by the Specifier.

8. No substitutions shall be accepted unless listed.

9. The Lumen Output column of the 'LIGHTING FIXTURE SCHEDULE' lists the nominal lumen output for each fixture type. Submitted fixture shall be capable of providing listed lumen output within 10% of listed lumen output.

10. Provide fixtures from a single manufacturer for each fixture type.

11. Pricing for light fixture types shall be through local lighting rep listed only.

B. General:

1. Ship fixtures factory assembled, complete in every respect, including all necessary parts, shown or not shown on the drawings, required for a complete installation in accordance with the manufacturer's recommendations.

2. EC to verify and provide fixture mounting options that are compatible with ceiling type as shown on the architectural drawings.

3. All low voltage lighting wiring shall be as recommended by the fixture manufacturer. Low voltage wiring shall be minimum #10 AWG Copper.

C. Listings:

1. Provide fixtures for use in damp or wet locations that are UL Listed for the specific installation.

2. Provide fixtures for recessed use in combustible construction that are UL Listed for the specific installation.

D. Fixture Construction:

1. Fixtures shall be designed with metal parts grounded as common unit.

2. Fixture housing shall be formed and supported to prevent warping and sagging.

3. Metal parts shall be free of burrs, sharp corners, and edges.

4. Doors, Frames, and Other Internal Access:

a. Smooth operating, free of light leakage under operating conditions, and designed to permit access without use of tools.

b. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally when secured in operating position.

c. All troffers with hinged doors shall have spring-loaded cam latches.

5. Provide metal trim rings for recessed downlights and wall wash type fixtures, unless noted otherwise.

6. Provide metal flange for recessed linear fixtures mounted in drywall construction, unless noted otherwise.

7. Provide drywall frame kits for recessed fixtures installed in other than suspended grid type acoustical ceiling systems.

8. Finishes:

a. Manufacturers' standard, unless otherwise indicated.

b. All troffers shall be post-painted or painted after fabrication, including driver covers, doors, and all trim. Fixtures shall be powder-finished with a minimum reflectance of 90%.

E. Light Engines:

1. Color temperature shall be 3500K, unless noted otherwise in the 'LIGHTING FIXTURE SCHEDULE'

2. Color Rendering Index: 80 CRI

3. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire light engine.

4. LED light engine shall be suitable for field maintenance or service from below the ceiling with plug-in connectors.

5. LED light engine shall be upgradable.

6. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to ensure proper operation of the light engine over the expected useful life.

2.02 *Drivers*

A. Manufacturers

1. Furnished with fixture as tested and recommended by fixture manufacturer as a complete lighting system.

2. All fixtures of the same type shall be furnished with the same manufactured driver type.

B. General:

1. All drivers shall be equipped with a disconnecting means internal to the fixture. The line side terminals of the disconnecting means shall be guarded. Provide Sta-Kon Series LD3 Luminaire Disconnect or equivalent.

2. LED driver shall be rated for dual 120/277 volt operation at 60 Hertz.

3. Drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays, or Systems".

4. Drivers shall have a sound rating of "A", have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

5. Dimmable LED drivers shall be 0-10V type, 10% minimum, unless noted otherwise on the 'LIGHTING FIXTURE SCHEDULE'.

6. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.

2.03 *Emergency Lighting*

A. Manufacturers

1. Provide lighting fixtures, of sizes, types and ratings indicated on the Drawings under the 'LIGHTING FIXTURE SCHEDULE' complete with, but not limited to, housings, drivers, and wiring.

B. Exit Signs:

1. General:

a. Comply with UL 924.

b. Light-emitting diodes, 70,000 hours minimum of rated lamp life.

c. Provide universal mounting kit, unless noted otherwise.

d. Provide single face with extra faceplate and color panel. Install extra faceplate where two-sided exit signs are indicated on drawings.

e. Provide with removable chevron inserts. Remove chevrons to match arrowhead(s) shown on drawings.

2. Battery:

a. Sealed, nickel cadmium with minimum 5-year nominal life.

b. Unit shall operate for a minimum of 90 minutes after power interruption.

c. Fully automatic current-limiting charger.

3. Battery Operation:

a. Relay automatically turns lamp(s) on when power supply circuit voltage drops to 80 percent of nominal voltage or below.

b. Lamp automatically disconnects from battery when voltage approaches deep-discharge level.

c. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Integral time-delay relay to hold unit on for fixed interval when power is restored after an outage.

e. Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

f. Test Switch and Light Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

C. Emergency Lighting Units:

1. General:

a. Self-contained units complying with UL 924.

b. Provide complete emergency battery units, including remote heads, as shown on drawings.

2. Battery:

a. Sealed, nickel cadmium with minimum 5-year nominal life.

b. Unit shall operate for a minimum of 90 minutes after power interruption.

c. Fully automatic current-limiting charger.

3. Battery Operation:

a. Relay automatically turns lamp(s) on when power supply circuit voltage drops to 80 percent of nominal voltage or below.

b. Lamp automatically disconnects from battery when voltage approaches deep-discharge level.

c. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Integral time-delay relay to hold unit on for fixed interval when power is restored after an outage.

e. Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

f. Test Switch and Light Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

2.04 *Fixture Support Components*

A. Comply with Division 26 Section 26 05 29 "Hangers and Supports for Electrical Systems" for additional support components not specified below.

B. Single-Stem Hangers: ½" steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Hook Hangers: Integrated assembly matched to fixture and equipped with threaded attachment. Provide with secondary safety cable connected to structure.

D. Aircraft Cable Support: Use cable and anchorages recommended by fixture manufacturer.

E. Suspension Bars: Provide Caddy Series 517, 520 or equal from fixture manufacturer.

F. T-Bar Support Clips: Provide Caddy Series 515 or equal from fixture manufacturer.

G. Ceiling Support System Wires:

1. General: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gauge.

2. Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.

2.05 *Fire Rated Ceiling Covers*

A. Where fire rated ceilings exist, provide a fire rated enclosure over the light fixture housing above the ceiling. Fire rated enclosure shall be the Fire Rated Light Enclosure as manufactured by Tenmat. Coordinate exact type of fire rated enclosure in field with Architect prior to purchase.

1. The test standard for this product shall be ASTM E-119/UL 263.

PART 3 EXECUTION

3.01 *Installation*

A. Inspection:

1. Inspect each fixture for damage prior to installation. Replace damaged fixtures and components.

2. Examine areas, structure, and other conditions under which lighting fixtures are to be installed and supported.

3. Review room finish schedule on architectural drawings for ceiling construction in each area and verify details with ceiling installer. Provide hardware and additional supporting devices as necessary to install lighting fixtures in each area.

4. Where lighting fixtures are recessed into ceiling construction, obtain information from the ceiling installer as to the specific type of ceiling to be installed, and provide recommended hardware and trim.

5. Review architectural drawings for fire rated ceiling assemblies and provide fire rated fixture enclosures as required.

B. General:

1. Install fixtures plumb, square, and level with ceiling and walls, and secure according to manufacturer's printed instructions and approved shop drawings.

2. Install lighting fixtures at locations and heights as indicated on drawings. Where mounting heights are not indicated, coordinate with architect prior to rough-in.

3. Install lighting fixtures in strict conformance with manufacturer's recommendations and instructions.

4. Install fixtures after building is enclosed, weathertight, and environmental conditions are nominally the same as expected for the completed spaces.

5. Recessed fixtures in suspended lay-in type grid ceilings shall have final connection of flexible metal conduit not exceeding 72".

6. Install recessed fixtures to eliminate light leakage between fixture frame and finished surface.

7. Install fire rated enclosures around light fixtures in fire rated ceilings. Mount enclosure prior to installation of finished ceiling.

8. Tighten connectors and terminals, including set screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL and NEC.

9. Adjust fixtures that require field adjustment or aiming.

10. Install remote drivers in accordance with manufacturer's recommendations.

C. Supports:

1. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight.

2. Able to maintain fixture position after cleaning or maintenance.

3. Provide support for fixture without causing deflection of ceiling or wall.

4. Fixture-mounting devices shall be capable of supporting a horizontal force of 100 percent of fixture weight and a vertical force of 400 percent of fixture weight.

5. Provide all necessary additional or auxiliary supporting steel for fixtures not mounted on building framework, and where necessary to span ceiling channels of suspended ceiling construction.

6. Support all fixtures directly from the building structure. Do not utilize any of the following items for support.

    a. Acoustic materials.

    b. Gypsum-base materials.

    c. Mechanical or plumbing items or equipment.

    d. Ceiling grid system.

    e. Ceiling grid system hangers.

7. Metal decking shall not be pierced for fixture support.

D. Flush Mounted Fixtures in Grid-Type Suspended Ceilings:

1. Install a minimum of two ceiling support system wires for each fixture from structural members. Locate not more than 6 inches from fixture corners.

2. Fasten fixtures to ceiling grid members at or near each fixture corner with support clips that are UL listed for the application.

3. For fixtures of sizes less than ceiling grid, install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two ¾ inch metal channels spanning and secured to ceiling tees.

E. Flush Mounted Fixtures in Drywall Ceilings:

1. Install a minimum of two ceiling support system wires for each fixture from structural members to fixture frame or frame kit.

2. Install drywall frames where required. Brace frames temporarily to prevent distortion during handling.

3. Install trim ring or flange flush with finished surface, where applicable.

4. Where fixtures are specified as trimless and utilizing a spackle flange, provide supporting structure along entire perimeter of fixture for support of flange.

5. Coordinate installations with ceiling installer.

F. Wall Mounted Fixtures:

1. Attached to junction box or as recommended by fixture manufacturer.

2. Do not attach fixtures directly to gypsum board.

G. Pendant Mounted Fixtures:

1. Do not use ceiling grid as support for pendant fixtures. Connect support wires or rods to building structure.

H. Surface Mounted Fixtures:

1. Secured to outlet box. Outlet box to be supported directly to structure.

2. Support fixtures that are centered in acoustical ceiling tile, independently with metal suspension bar spanning an electrical outlet box and clipped to the ceiling grid tees.

3. Support fixtures that are centered on ceiling grid structure independent of ceiling grid, using support clips that wrap around grid. The support clip shall include means for fixture mounting. Provide a wire hanger from clip to structure.

4. Support surface-mounted fixtures greater than 2' in length at a point in addition to the outlet box.

3.02 *Coordination*

A. Coordinate layout and installation of lighting fixtures and supports with other construction that penetrate ceilings or are supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

B. Sequence lighting fixture installation with other work to reduce the possibility of damage to fixtures during remainder of construction period.

3.03 *Field Quality Control*

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Verify normal operation of each fixture after fixtures have been installed and circuits have been energized. Replace or repair malfunctioning fixtures and components.

C. During warranty period, replace fixtures that show any signs of corrosion.

D. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

3.04 *Adjusting And Cleaning*

A. Remove protective wrapping on fixtures before installation of furniture, but after interior finish work, such as painting and carpeting, is completed.

B. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer. Lenses and louvers with dust, dirt, scratches, or fingerprints shall not be acceptable.

3.05 *Startup Service*

A. Burn-in LED fixtures prior to occupancy by Owner for a minimum of 100 hours at full light output.

3.06 *Grounding*

A. Provide equipment grounding connections for all lighting fixtures. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

END OF SECTION 26 51 00

SECTION 26 90 80 - COMMISSIONING OF COMMUNICATIONS

PART 1 GENERAL

1.01 *Scope of Work*

A. This Section includes the minimum requirements for the test certification, identification and administration of horizontal copper cabling.

B. This Section includes minimum requirements for:

1. Copper cabling test instruments
2. Copper cabling testing
3. Identification
    a. Labels and labeling
4. Administration
    a. Test results documentation
    b. As-built drawings

C. Testing shall be carried out in accordance with this document.

D. Testing shall be performed on each cabling link (connector to connector).

E. Testing shall be performed on each cabling channel (equipment to equipment) that is identified by the owner.

1. Testing shall not include any active devices or passive devices within the link or channel other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

F. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.

G. In order to conform to the overall project event schedule, the cabling contractor shall survey the work areas and coordinate cabling testing with other applicable trades.

H. In addition to the tests detailed in this document, the contractor shall notify the Owner or the Owner's representative of any additional tests that are deemed necessary to guarantee a fully functional system. The contractor shall carry out and record any additional measurement results at no additional charge.

I. Related Sections:

1. Consult all other Sections and Divisions, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to completely test a complete and operable system.

2. Section 26 95 00: Communications Cabling

1.02 *Definitions*

A. The following list of terms as used in this specification shall be defined as follows:

1. "Channel": Shall mean a testing configuration which includes the Permanent Link and the line cord (at the workstation), the equipment cord, and if a full cross connection is implemented, a patch cord and the cross connect termination/connecting apparatus.

2. "Connect": Shall mean install all required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical circuit.

3. "Cord": Shall mean a length of cordage having connectors at each end. The term "Cord" shall be synonymous with the term "Jumper". The cord may be:

a. Unshielded twisted pair

4. "Permanent Link": Shall mean the 'permanent' portion of the Horizontal cabling to each outlet with the test cords de-embedded from the measurements; this includes cable, consolidation point (if used), termination/connecting apparatus in the IDF and the connector at the outlet.

5. "System Cord": Shall mean the cord used in the operating electrical circuit.

6. "CONSOLIDATION POINT" shall mean a location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

7. "Test Cord": Shall mean the cord certified for use in testing, as described in this section.

8. "CROSS-CONNECT" shall mean a facility enabling the termination of cable elements and their interconnection or cross-connection.

9. "MUTOA" shall mean a grouping in one location of several telecommunications outlet/connectors.

10. "OUTLET/CONNECTORS" shall mean a connecting device in the work area on which horizontal cable or outlet cable terminates.

1.03 *Submittals*

A. Preconstruction Submittal Requirements:

1. Testing Procedures Submittal, describing step-by-step procedures used by the field technicians.

2. Product Submittal, including cut sheets of testing equipment to be used (note all software/firmware versions as applicable) and certificate of last calibration.

3. Schedule Submittal, consisting of proposed schedule of work.

B. Submittal Requirements at Closeout:

1. Record Documents.

C. Submittal Description: Record Documents

1. Test Reports: Record documents submittal shall include test reports showing the following information:

a. A title page which includes:

1) Client Name

2) Project Name

3) Project Address

4) General Contractor name / Telecommunications Installer name

5) Date of Submittal

b. Individual tabs which break down the test results by building, and then by telecommunications room.

c. All Horizontal cable test results, per cable

2. Furnish all test results on CD-ROM in their native data format and an exported Microsoft Excel compatible format.

a. Include all necessary software to allow viewing and printing of individual test results.

b. CD shall be labeled with the project name, contractor name, and date of submission.

1.04 *Quality Assurance*

A. All testing procedures and field-test instruments shall comply with applicable requirements of:

1. ANSI/TIA-1152, Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

2. ANSI/TIA-568-0.D, Generic Telecommunications Cabling for Customer Premises.

3. ANSI/TIA-568-1.D, Commercial Building Telecommunications Cabling Standard

4. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

5. ANSI/TIA-606-B, Administration Standard for Commercial Telecommunications Infrastructure, including the requirements specified by the customer, unless the customer specifies their own labeling requirements.

B. Trained technicians who have successfully attended an appropriate training program, and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

1. Manufacturer of the connectors or cable.

2. Manufacturer of the test equipment used for the field certification.

3. Training organizations (e.g., BICSI, A Telecommunications Association headquarters in Tampa, Florida; ACP [Association of Cabling Professionals™] Cabling Business Institute located in Dallas, Texas)

C. The Owner or the Owner's representative shall be invited to witness and/or review field-testing.

1. The Owner or the Owner's representative shall be notified of the start date of the testing phase five business days before testing commences.

2. The Owner or the Owner's representative will select a random sample of five percent of the installed links. The Owner or the Owner's representative shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation contractor. If more than two percent of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat one hundred percent testing at no cost to the Owner.

1.05 *Warranty*

A. Warrant the validity of the test results. Under no circumstances shall any cable's test results be substituted for another's. If a single instance of falsification is confirmed, the

Contractor shall be liable for a complete retest of the cabling system at no additional cost to the Owner. This includes the retaining the services of a neutral party to observe all retesting.

PART 2 PRODUCTS

2.01 *General*

A. The manufacturer may change the product numbers listed in this Section at any time, as well as software and firmware versions. In the event this Section contains an invalid product number or conflicts with the written description, or specifies an out-of-date software and/or firmware version, notify the Engineer in writing prior to issuing submittals or field testing.

2.02 *Balanced Twisted-Pair Cable Testers*

A. The field-test instrument shall be within a 12 month calibration period.

B. Certification tester

1. Accuracy

a. Level IIIe accuracy in accordance with ANSI/TIA-1152-A

b. Independent verification of accuracy shall be provided

c. Acceptable manufacturer

1) Fluke Networks

2. Permanent Link Adapters

a. RJ45 plug must meet the requirements for NEXT, FEXT and Return Loss in accordance with ANSI/TIA-568-C.2 Annex C

b. Twisted pair Category 5e, 6, 6A, 7 or 7_A cords are not permitted as their performance degrades with use and can cause false Return Loss failures

3. Results Storage

a. Must be capable of storing > 10,000 results for all measurements found in 2.1.B.4 below

4. Measurement capabilities

a. Wire Map

b. Length

c. Propagation Delay

d. Delay Skew

e. DC Loop Resistance

f. DC Resistance Unbalance within a pair

g. DC Resistance Unbalance between pairs

h. Insertion Loss

i. NEXT (Near-End Crosstalk)

j. PS NEXT (Power Sum Near-End Crosstalk)

k. ACR-N (Attenuation to Crosstalk Ratio Near-End)

l. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)

m. ACR-F (Attenuation to Crosstalk Ratio Far-End)

n. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)

o. Return Loss

p. TCL (Transverse Conversion Loss)

q. ELTCTL (Equal Level Transverse Conversion Transfer Loss)

r. Time Domain Reflectometer

s. Time Domain Xtalk Analyzer

t. PS ANEXT (Power Sum Alien Near-End Crosstalk)

u. Average PS ANEXT (Average Power Sum Alien Near-End Crosstalk)

v. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

w. Average PS AACR-F (Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

C. PC Software

1. LinkWare PC

2.03 *Identification*

A. Labels

1. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

2. Shall be preprinted using a mechanical means of printing (e.g., laser printer).

3. Where used for cable marking, provide vinyl substrate with a white printing area and a clear "tail" that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.

4. Where insert type labels are used provide clear plastic cover over label.

5. Provide plastic warning tape 6 inches wide continuously printed and bright colored 18" above all direct buried services, underground conduits and duct-banks.

6. Acceptable Manufacturers:

   a. Panduit

   b. Silver Fox

   c. W.H. Brady

   d. d-Tools

   e. Brother

   f. Dymo

   g. Epson

2.04 *Administration*

A. Administration of the documentation shall include test results of each fiber link and channel.

B. Administration of the documentation shall include test results of each Permanent Link.

C. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.

D. The test result records saved within the field-test instrument shall be transferred into a Windows-based and/or cloud-based database utility that allows for the maintenance, inspection and archiving of these test records.

E. The test result records saved within the field-test instrument shall be transferred to LinkWare PC via LinkWare Live.

F. Alien Crosstalk measurements shall be stored to a PC upon completion of the test.

PART 3 EXECUTION

3.01 *Scheduling*

A. Schedule both the Engineer of Record and a representative of the test equipment manufacturer for a demonstration of testing methods. Execute a demonstration of testing methods with aforementioned parties prior to 'production' testing activities. Test reports and acceptance testing will not be accepted without proof of methods demonstration.

3.02 *Field Quality Control*

A. Complete testing as delineated below prior to system acceptance.

B. Permanently record all test results and presented in a format acceptable to the Owner or Engineer before system acceptance.

C. Remove and replace with new, at no cost to the Owner, any cables or conductors (copper or glass) failing to meet the indicated standards. The Owner will not accept the installation until testing has indicated a 100% availability of all cables and conductors or the Owner has approved any deviation from this requirement.

D. Calibrate test sets and associated equipment per the manufacturers printed instructions at the beginning of each day's testing and after each battery charge. Fully charge the test sets prior to each day's testing to ensure proper operation.

3.03 *Balanced Twisted Pair Cable Testing*

A. Precautions:

1. Adhere to the equipment manufacturer's instructions during all testing.

2. Prior to any testing activity or any measurements taken, ensure the test equipment is at room temperature - approximately 70°F (e.g., if necessary, bring the test equipment in from outdoors and let it set for about 15 minutes or for however long it takes to bring the test equipment to reach room temp).

3. Fully charge power sources before each day's testing activity

B. Field test instruments shall have the latest firmware installed.

C. Permanent Link test results, including the individual frequency measurements from the tester, shall be recorded in the test instrument upon completion of each test for subsequent uploading to LinkWare PC via LinkWare Live in which the administrative documentation (reports) may be generated.

D. Permanent Link testing shall be performed on each cabling segment (connector to connector). Sampling is not acceptable.

E. Alien Crosstalk testing shall be performed using a sampling plan. An acceptance quality level (AQL) of 0,4 %, normal inspection, general inspection level I as defined in ISO 2859-1 for populations of up to 500,000 links shall be used. The following table represents this sampling level.

Total number of links (N)	**Sample size (No. of links to test)**
3 - 33	3 or 0.1 x N (whichever is greatest)
34 - 3,200	33
3,201 - 35,000	126
35,001 - 150,000	201
150,001 - 500,000	315

F. Disturbed (Victim) links chosen for Alien Crosstalk testing shall be an equal combination of short, medium and long links.

G. Permanent Link adapters made from twisted pair Category 5e, 6, 6A, 7 or 7_A cords are not permitted as their performance degrades with use and can cause false Return Loss failures.

H. The installer shall build a reference link. All components shall be anchored so it is not possible to disturb them. The technician is to conduct a Category 6A Permanent Link test each day to ensure no degradation of the tester or its Permanent Link adapters.

I. Wire Map Measurement

1. The wire map test is intended to verify pin-to-pin termination at each end and check for installation connectivity errors.

2. For each of the eight conductors in the cabling, the wire map indicates:

   a. Continuity to the remote end

   b. Shorts between any two or more conductors

   c. Reversed pairs

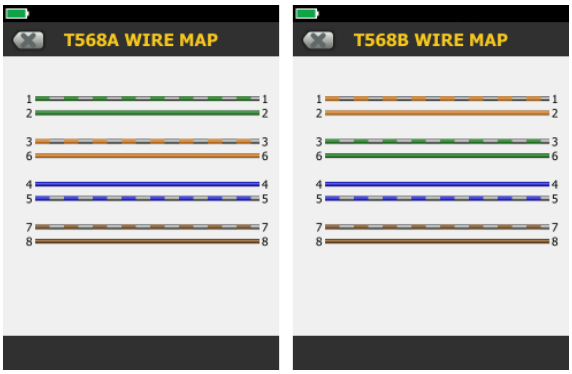
   d. Split pairs

   e. Transposed pairs

f. Distance to open on shield

g. Any other miss-wiring

3. The correct connectivity of telecommunications outlets/connectors is defined in ANSI/TIA-568-C.2. Two color schemes are permitted. The user shall define which scheme is to be used. The field tester shall document which color scheme was used. Examples are given below:



J. Length Measurement

1. The length of each balanced twisted pair shall be recorded.

2. Since physical length is determined from electrical length, the physical length of the link calculated using the pair with the shortest electrical delay shall be reported and used for making the pass or fail determination.

3. The pass or fail criteria is based on the maximum length allowed for the Permanent Link as specified in ANSI/TIA-568-C.2 plus the nominal velocity of propagation (NVP) uncertainty of 10%. For a Permanent Link, the length measurement can be 325 ft. (99 m) before a fail is reported.

K. Propagation Delay measurement

1. Is the time it takes for a signal to reach the end of the link.

2. The measurement shall be made at 10 MHz per ANSI/TIA-1152.

3. The propagation delay of each balanced twisted pair shall be recorded.

4. Is not to exceed 498 ns per ANSI/TIA-568-C.2 Section 6.3.18.

L. Delay Skew measurement

1. Is the difference in propagation delay @ 10 MHz between the shortest delay and the delays of the other wire pairs.

2. The delay skew of each balanced twisted pair shall be recorded.

3. Is not to exceed 44 ns per ANSI/TIA-568-C.2 Section 6.3.19.

M. DC Loop Resistance

1. Often reported as Resistance, is the DC loop resistance of both conductors in the pair.

2. The DC Resistance shall be reported for all four pairs.

3. Is not to exceed 21 Ω for all four pairs per ANSI/TIA-568-C.2 Section 6.3.1.

N. DC Resistance Unbalance within a pair

1. Is the difference in DC resistance of the two wires within the same pair.

2. The DC Resistance Unbalance within a pair shall be reported for all four pairs.

3. Is not to exceed 200 mΩ or 3%, whichever is the greatest per ANSI/TIA-568-C.2 Section 6.2.2.

O. DC Resistance Unbalance between pairs

1. Is the difference in DC parallel resistance of the conductors of a pair compared to the DC parallel resistance of another pair, given in the formula below:

$$Resistance_Unbalance_{Between_pairs} = \left(\frac{|R_{P1} - R_{P2}|}{R_{P1} + R_{P2}} \right) 100\%$$

Where:
R_{P1} is the DC parallel resistance of the conductors of a pair.
R_{P2} is the DC parallel resistance of the conductors of another pair.

2. The DC Resistance Unbalance shall be reported for the following pairs

   a. 1,2-3,6

   b. 1,2-4,5

   c. 1,2-7,8

   d. 3,6-4,5

   e. 3,6-7,8

   f. 4,5-7,8

3. Is not to exceed 200 mΩ or 7.5%, whichever is the greatest.

P. Insertion Loss

1. Is the loss of signal strength over the cabling (in dB).

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in one direction for all four pairs.

4. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.7.

Q. NEXT (Near-End Crosstalk)

1. Is the difference in amplitude (in dB) between a transmitted signal and the crosstalk received on other wire pairs at the same end of the cabling.

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for the following pair combinations

   a. 1,2-3,6

   b. 1,2-4,5

   c. 1,2-7,8

   d. 3,6-4,5

e. 3,6-7,8

f. 4,5-7,8

4. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.8.

5. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

6. The Time Domain Xtalk data shall be stored for any marginal or failing NEXT results.

R. PS NEXT (Power Sum Near-End Crosstalk)

1. Is the difference (in dB) between the test signal and the crosstalk from the other pairs received at the same end of the cabling.

2. The frequency resolution shall be:

a. 1 - 31.25 MHz: 150 kHz

b. 31.25 - 100 MHz: 250 kHz

c. 100 - 250 MHz: 500 kHz

d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.

4. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.9.

5. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

6. The Time Domain Xtalk data shall be stored for any marginal or failing PS NEXT results.

S. ACR-N (Attenuation Crosstalk Ratio Near-End)

1. Is a calculation of NEXT minus Insertion Loss of the disturbed pair in dB.

2. The frequency resolution shall be:

a. 1 - 31.25 MHz: 150 kHz

b. 31.25 - 100 MHz: 250 kHz

c. 100 - 250 MHz: 500 kHz

d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for the following pairs

a. 1,2-3,6

b. 1,2-4,5

c. 1,2-7,8

d. 3,6-4,5

e. 3,6-7,8

f. 4,5-7,8

4. Although not specified in ANSI/TIA-568-C.2, it shall be recorded for all twelve possible combinations.

T. PS ACR-N (Power Sum Attenuation Crosstalk Ratio Near-End)

1. Is a calculation of PS NEXT minus Insertion Loss of the disturbed pair in dB.

2. The frequency resolution shall be:

a. 1 - 31.25 MHz: 150 kHz

b. 31.25 - 100 MHz: 250 kHz

c. 100 - 250 MHz: 500 kHz

d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.5

4. Although not specified in ANSI/TIA-568-C.2, it shall be recorded for all eight possible combinations.

U. ACR-F (Attenuation Crosstalk Ratio Far-End)

1. Is a calculation of FEXT minus Insertion Loss of the disturbed pair in dB.

2. The frequency resolution shall be:

a. 1 - 31.25 MHz: 150 kHz

b. 31.25 - 100 MHz: 250 kHz

c. 100 - 250 MHz: 500 kHz

d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for the following pairs

a. 1,2-3,6

b. 1,2-4,5

c. 1,2-7,8

d. 3,6-1,2

e. 3,6-4,5

f. 3,6-7,8

g. 4,5-1,2

h. 4,5-3,6

i. 4,5-7,8

j. 7,8-1,2

k. 7,8-3,6

l. 7,8-4,5

4. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.11.

5. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

V. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)

1. Is a calculation of PS FEXT minus Insertion Loss of the disturbed pair in dB.

2. The frequency resolution shall be:

a. 1 - 31.25 MHz: 150 kHz

b. 31.25 - 100 MHz: 250 kHz

c. 100 - 250 MHz: 500 kHz

d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.

4. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.13.

5. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

W. Return Loss

1. Is the difference (in dB) between the power of a transmitted signal and the power of the signals reflected back.

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.

4. Shall be ignored at all frequencies where the Insertion Loss is less than 3 dB for that pair.

5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.6.

6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

7. The Time Domain Reflectometer data shall be stored for any marginal or failing Return Loss results.

X. TCL (Transverse Conversion Loss)

1. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the near-end on the same wire pair.

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.

4. Is not to exceed the Category 6A limits found ANSI/TIA-568-C.2 Section 6.2.14.

Y. ELTCTL (Equal Level Transverse Conversion Transfer Loss)

1. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the far end on the same wire pair minus the Insertion Loss of that pair.

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. Both worst case and worst margins shall be reported in both directions for all four pairs.

4. Is not to exceed the Category 6A limits found in ANSI/TIA-568-C.2 section 6.2.16.

Z. PS ANEXT (Power Sum Alien Near-End Crosstalk)

1. Takes into account the combined alien crosstalk (statistical) on a receive pair from all external near-end disturbers operating simultaneously.

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. The disturbed (victim) link shall have disturber links to the left and right of it and if present, links above and below it.

4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links

5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.

6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.21.

AA. Average PS ANEXT (Power Sum Alien Near-End Crosstalk)

1. Is calculated by averaging the individual PSANEXT loss values, in dB, for all four pairs in the disturbed (victim) link.

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.22.

BB. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

1. AFEXT loss is the coupling of crosstalk at the far-end from external link pairs into a disturbed (victim) pair of the 4-pair link under test. PS AACR-F is the calculated power sum from all external pairs into the disturbed (victim) pair.

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. The disturbed (victim) link shall have disturber links to the left and right of it and if present, links above and below it.

4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links

5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.

6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.25.

CC. Average PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

1. Is calculated by averaging the individual PS AACR-F values, in dB, for all four pairs in the disturbed (victim) link.

2. The frequency resolution shall be:

   a. 1 - 31.25 MHz: 150 kHz

   b. 31.25 - 100 MHz: 250 kHz

   c. 100 - 250 MHz: 500 kHz

   d. 250 - 500 MHz: 1000 kHz

3. The disturbed (victim) link shall have disturber links to the left and right of it and if present, links above and below it.

4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links

5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.

6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568-C.2 Section 6.3.26.

DD. Administration

1. Test results documentation

   a. The Permanent Link test results (excluding alien xtalk testing) shall be uploaded to LinkWare Live at the end of each working day for inspection by the Owner or the Owner's representative.

   b. Test results uploaded to LinkWare Live shall be transferred into LinkWare PC to allow for the maintenance, inspection and archiving of the test records.

   c. The database for the complete project, including fiber links, if applicable, shall be stored in LinkWare PC format (*.flw) and delivered on CD or DVD prior to Owner acceptance of the building. This CD or DVD shall include a copy of LinkWare PC to allow the inspection and printing of the test reports.

   d. Circuit IDs reported by the test instrument should match the specified label ID (see 2.2 of this Section).

e. For Permanent Link testing, the detailed test results documentation data is to be provided in LinkWare PC for each tested balance twisted-pair and shall contain the following information:

1) Measured values of minimum requirements.

2) The overall Pass/Fail evaluation of the link-under-test

3) The date and time the test results were saved in the memory of the tester

4) The identification of the customer site as specified by the end-user

5) The name of the test limit selected to execute the stored test results

6) The name of the personnel performing the test

7) The version of the test firmware and the version of the test limit database held within the test instrument

8) The manufacturer, model and serial number of the field-test instrument

9) The adapters used

10) The factory calibration date

11) Wire Map

12) Propagation Delay values, for all four pairs

13) Delay Skew values, for all four pairs

14) DC Resistance values, for all four pairs

15) DC Resistance Unbalance within a pair, values for all four pairs

16) DC Resistance Unbalance between pairs, values for all four pairs

17) Insertion Loss, worst case values for all four pairs

18) NEXT, worst case margin and worst case values, both directions

19) PS NEXT, worst case margin and worst case values, both directions

20) ACR-N, worst case margin and worst case values, both directions

21) PS ACR-N, worst case margin and worst case values, both directions

22) ACR-F, worst case margin and worst case values, both directions

23) PS ACR-F, worst case margin and worst case values, both directions

24) Return Loss, worst case margin and worst case values, both directions

25) TCL, worst case margin and worst case values, both directions

26) ELTCTL, worse case margin and worse case values, both directions.

27) Time Domain Crosstalk data if the link is marginal or fails

28) Time Domain Reflectometer data if the link is marginal or fails

f. For Alien Crosstalk testing, the detailed test results documentation data is to be provided in AxTalk Analyzer for each tested balance twisted-pair and shall contain the following information

1) The overall Pass/Fail evaluation of the link-under-test

2) The date and time the measurements were made

3) The identification of the customer site as specified by the end-user

4) The name of the test limit selected to execute the stored test results

5) The name of the personnel performing the test

6) The version of the test software

7) PS ANEXT, worst case margin for all four pairs

8) Average PS ANEXT, worst case margin

9) PS AACR-F, worst case margin for all four pairs

10) Average PS AACR-F, worst case margin

END OF SECTION 26 90 80

SECTION 26 91 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.02 *Summary*

A. This section includes the following:

1. Racks

2. Cabinets

B. This Section includes solid grounding of communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

C. Provide proper grounding of all racks, cabinets, and active components as shown on the Drawings and as specified herein.

1.03 *Submittals*

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data: Submit manufacturer's data for racks, cabinets and active components.

1.04 *Quality Assurance*

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings of types and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer: Qualified with at least 3 years of successful installation experience on projects with communications grounding work similar to that required for project.

C. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

1. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

D. Field Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code" (NEC).

F. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to grounding and bonding.

G. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to grounding.

1.05 *Description of Work*

A. Provide all equipment, including but not limited to, equipment racks, cabinets, mounting hardware, and all associated equipment necessary to provide a complete and operating system.

B. All bids shall be based on equipment as specified herein. All alternate equipment must be approved ten (10) days prior to bid date. Adequate information must be made available for an evaluation and approval of alternate equipment.

C. Contractor shall furnish a manufacturer's manual of the completed system including individual specification sheets, schematics, inter-panel and intra-panel wiring diagrams. In addition, all information necessary for the proper maintenance and operation of the system must be included. Any bidder using other than the specified equipment must provide this information prior to bidding. All published specifications of the manufacturers of equipment specified shall be considered as being a part of this specification, even though they have not been included in detail.

D. As-built drawings that include any changes to wiring, wiring designations, junction box labeling and any other pertinent information shall be supplied upon completion of project.

E. Wire management shall be in accordance with the recommended practices as established by BISCI.

F. All equipment installation and wiring shall meet all requirements of manufacturer.

1.06 *Coordination*

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and services suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in in rooms to accommodate and optimize arrangement and space requirements of the telephone switch and LAN equipment.

4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with location of communications equipment requiring electrical power to operate.

PART 2 PRODUCTS

2.01 *Connector Products*

A. General: Listed and labeled as grounding connectors for the materials used.

B. Pressure Connectors: High-conductivity-plated units.

C. Bolted Clamps: Heavy-duty units listed for the application.

2.02 *Grounding Electrodes*

A. Bonding Plates, Connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.

B. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

C. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 3/8 inch thick x ¾ inch wide.

2.03 *Communication Room Equipment*

A. Manufacturers: Provide products manufactured by Panduit or one of the following approved manufacturers.

1. Panduit

2. Legrand

3. Cooper B-Line

B. Provide the following equipment, including but not limited to, the purchase, delivery, unpacking, installation, connection, testing, and operation of the same.

C. The quantities of items required shall be as shown on the drawings, or as stated below. Where a conflict exists between the quantities shown on the drawings, and the quantities stated hereinafter, the greater of the two quantities shall be used.

D. 2 Post Floor Rack

1. Manufacturer/Model No.: Panduit R2P6S or approved equal.

2. Requirements:

a. Unit shall be standard 21" width by 84" high

b. Unit shall be painted black

3. Accessories:

a. Include all accessories shown on details and the following:

1) Vertical PDU: CMRPSV20

2) Anchoring Kit: RFAKIT

3) #12-24 x 0.5" Screws (100 count): S1224-C

4) Provide engraved label at top center of rack indicating rack number.

E. Wall Cabinet

1. Manufacturer/Model No.: Cooper B-Line SB706193818FB or approved equal.

2. Requirements:

a. Unit shall be standard 19" width by 38" high

b. Unit shall be painted black

3. Accessories:

a. Hardware

1) Provide vertical cable management racks on both side of rack, full height.

2) Provide one horizontal cable management for each 24-port patch panel and two horizontal cable management for each 48-port patch panel installed on the rack, Cooper B-Line SB8701952FB or approved equivalent.

3) Provide one rack mounted, 6 position power strips per wall rack, Cooper B-line No. SB3005615FB or approved equivalent.

4. Quantity - as shown on the Drawings.

5. Provide engraved label at top center of rack indicating rack number.

F. Electrostatic Discharge Kit

1. Manufacturer/Model No.: Panduit Corporation, part no. RGESD-1 approved equal.

2. Description: One-hole barrel lug, angled at 45-degrees, permanently marked with protective earth (ground) symbol, designated to accommodate a 4mm ESD wrist strap plug. Kit shall include an antioxidant compound, and one #12-24x ½" threaded-forming screw.

3. Quantity: Provide one kit for each Telecommunications Closet or wall cabinet.

PART 3 EXECUTION

3.01 *General*

A. Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), bonding jumper braid, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements selection is Installer's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.

3.02 *Inspection*

A. Installer must examine areas and conditions under which grounding connections are to be made and notify the Architect in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.03 *Application*

A. Provide grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.

3.04 *Installation*

A. General: Ground communications systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.

B. Coordinate with other electrical work as necessary to interface installation of communication system grounding system with other work.

C. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

3.05 *Backboards*

A. Equipment backboards shall be mounted on all walls from 6" AFF to 8'-6" AFF. Backboards shall be mated to each other so that no gap between boards is more than 1/4".

B. Backboards shall be securely mounted to the existing walls. If attached to masonry walls, expandable anchors shall be used to secure the plywood to the walls. Backboards attached to studded walls shall have screws that penetrate the studs to provide secure attachment. If there is plywood backing in the wall, screws that penetrate the backing material can be used in lieu of penetrating the studs.

3.06 *Equipment Installation*

A. Install equipment racks with manufacturer approved installation hardware. All equipment racks shall be securely bolted to the floor with four bolts.

B. Equipment racks shall be supported at the top of the rack using cable tray, cable runway or supports attached to the wall. These supporting devices shall add rigidity to the rack for ease in working on equipment mounted in the rack.

C. Equipment cabinets shall be assembled and secured as recommended by the manufacturer. All doors, panels and equipment shall be securely mounted to the equipment cabinet by means of fasteners designed to fasten these devices.

D. All equipment cabinets and racks shall be grounded to the grounding bus bar with individual #6 AWG grounding conductors.

E. Label all equipment racks and cabinets to meet the requirements of TIA/EIA-60

3.07 *Grounding*

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum 3/0 AWG grounding electrode conductor from grounding bus bar to suitable

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

E. Fasteners for grounding lugs shall be machine screws with either nuts or tapped holes for securing the grounding lug to the equipment to be grounded. Self-tapping screws are not acceptable for grounding connections.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

END OF SECTION 26 91 00

SECTION 26 95 00 - COMMUNICATIONS CABLING

PART 1 GENERAL

1.01 *Related Documents*

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section:

1.02 *Summary*

A. Section Includes:

1. UTP cabling.

2. Coaxial cable.

3. Cable connecting hardware, patch panels, and cross-connects.

4. Telecommunications outlet/connectors.

5. Cabling system identification products.

B. Related Requirements:

1. Section 26 90 80 "Commissioning of Communications" for testing requirements.

C. Intent:

1. It is the intent of this section for the Contractor to provide a complete workable cabling system ready for the Owner's use in accordance with TIA 568-C standards to support high speed data applications up to and in excess of 1000Mbs including IEEE system standards based on Twisted Pair Distributed Data Interface (TPDDI), Ethernet, Fast Ethernet, Gigabit Ethernet and Asynchronous Transmission Mode (ATM).

D. Related Work to be provided by the Owner or their Representative:

1. Installation of workstation devices: computers, terminals, telephones, and similar equipment.

2. Installation of patch cords or cross connect wire to connect workstation devices to network equipment and backbones.

1.03 *Administrative Requirements*

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.04 *Action Submittals*

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. Submittals shall be made as complete systems including all required accessories and special installation tools (i.e. termination hardware).

C. Provide information regarding all terminations that will be required to complete this installation. This information shall include complete specifications and installation instructions.

D. Product Data: For each type of product.

1. Provide manufacturer's product data sheets for the following equipment:

a. Patch Panels (UTP, etc.)

b. Data and Voice Jacks

c. Faceplates

d. Cable (UTP, etc.)

e. Patch cords

f. Cable Management Devices

g. Labeling

h. All other equipment identified or inferred. Submit complete list for Engineer/Owner approval.

2. Provide manufacturer's installation data for all cabling, include the following for each type used:

a. Nominal OD.

b. Minimum bend radius.

c. Maximum pulling tension.

d. Recommended installation pulling points. (i.e. every 180 degrees of bend in the raceway, or every 100 feet of raceway)

e. Recommended pulling lubricants.

3. Provide manufacturer's performance data for UTP cabling, include the following for each type used:

a. DC Resistance

b. Characteristic Impedance

c. Attenuation

d. Near-end Crosstalk (NEXT)

e. Far-end Crosstalk (FEXT)

f. Nominal Velocity of Propagation and Propagation Delay

g. Attenuation to Crosstalk Ratio (ACR)

h. Return Loss

i. Delay skew

1.05 *Informational Submittals*

A. Qualification Data: For installers, qualified layout technicians, installation supervisor, and field inspector.

B. Source quality control reports.

C. Field quality control reports.

1.06 *Closeout Submittals*

A. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

B. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.

C. Cabling administration drawings and printouts.

D. Wiring diagrams to show typical wiring schematics, including the following:

1. Cross-connects.

2. Patch panels.

3. Patch cords.

E. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.07 *Quality Assurance*

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. A Certification Warranty shall provide a warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 20 years. Unless otherwise noted all following sections, which describe such actions, tasks, and responsibilities refer to the Contractor.

a. A manufacturer trained and certified contractor shall complete network installation. A copy of the Contractor certification shall be submitted in the proposal.

b. A manufacturer trained and certified contractor shall have a Superintendent on the job with at least 10 years of experience.

c. A manufacturer trained and certified contractor shall have at least one BICSI RCDD on staff locally.

2. Layout Responsibility: Preparation of Shop Drawings by an RCDD.

3. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

4. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: A Nationally Recognized Test Laboratory (NRTL).

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Comply with the following Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA) Standards:

1. ANSI/TIA 568.1-D "Commercial Building Telecommunications Wiring Standard"

2. ANSI/TIA568-C.2 “Balanced Twisted-Pair Telecommunications Cabling and Components Standard”

3. ANSI/TIA 569-D, " Telecommunications: Pathways and Spaces "

4. ANSI/TIA 606-B, " Administration Standard for Commercial Telecommunications Infrastructure "

5. EIA 258, "Semi Flexible Air Dielectric Coaxial Cables and Connectors, 50 Ohms."

D. UL Compliance: Comply with applicable requirements of UL Standard 910 "Test Method for Fire and Smoke Characteristics of Cables Used in Air Handling Spaces." Provide products that are UL listed and labeled for such use.

1.08 *Delivery, Storage, and Handling*

A. Deliver cable factory packaged in containers or reels. Store in clean dry space and protect products from damaging fumes and traffic. Handle wire and cable carefully to avoid damage.

B. If cables are stored below 32°F bring cable indoors and store at room temperature 68°F for 48 hours prior to installation.

C. The Contractor shall ensure that the General Contractor and Painting Contractor acknowledge that painting of or over spray any single or group of 4 pair horizontal telecommunications Category 5e, Category 6 or Category 6a or backbone cable is not allowed. Any painted or over sprayed cable(s) shall be replaced at the painting contractor's expense. Painted Cable will not be covered as part of an extended warranty. Painted cable in addition to obscuring the print legend may act as an accelerant or create an additional smoke hazard in the event of a fire and as such this is considered a life safety issue.

D. Test cables upon receipt at Project site.

1. Test each pair of UTP cable for open and short circuits.

1.09 *Warranty/Warranty Manuals*

A. Warranty and Certification of the Structural Cabling System:

1. The Contractor shall provide a minimum twenty year product and performance warranty that all cable, connectors, and connecting hardware shall be free from defects in material, workmanship and fabrication.

2. The system shall be certified by the cable/component manufacturer and warranted for the specified performance for a minimum of twenty years. The Contractor shall conform to the manufacturer's certification program including submittal of all required documentation to the manufacturer.

3. The Contractor shall obtain, from the manufacturer, a Registration Document and Certificate for the specific installation. Upon receipt of the Registration Document

and Certificate, the Contractor shall forward a copy to the Engineer and deliver the original to the Owner.

B. Provide complete warranty information for each item to include date of beginning of warranty, names, addresses, telephone numbers, and procedures for filing a claim to obtain warranty service.

C. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty-four hours.

PART 2 PRODUCTS

2.01 *Horizontal Cabling Description*

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. TIA-568-D requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.

3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

2.02 *Performance Requirements*

A. General Performance: Horizontal cabling system shall comply with transmission standards in ANSI/TIA-568.1-D when tested according to test procedures of this standard.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Grounding: Comply with ANSI/TIA-607-C.

2.03 *UTP Cable, Patch Cords, and Hardware*

A. Products: Subject to compliance with requirements, provide products by Panduit/General Cable, or one of the following approved manufacturers:

1. 1Gb/s Category 6 Solution (Midgrade) (For all data cable except to Wireless Access Points)

a. Mohawk/Belden

1) Plenum Cabling: AdvanceNet CMP M57193

2) Indoor/Outdoor: VersaLAN M58772

3) OSP Cabling: LAN-Trak M57622

4) Jacks:KeyConnect 6+ AX10xxxx

5) Patch Panels:AX103121 (Modular, Flat)

6) Patch Cords: C60110x00xx

b. General Cable/Panduit

1) Plenum Cabling: GenSPEED 6000 CMP

2) Indoor/Outdoor: N/A

3) OSP Cabling: N/A

4) Jacks:Mini-Com TX6 CJ688TGxx

5) Patch Panels: CPPL48WBLY (Modular, Flat)

6) Patch Cords: UTPSPxx

c. CommScope

1) Cabling: CS37P

2) Indoor/Outdoor: N/A

3) OSP Cabling: 1571A

4) Jacks: USL600

5) Patch Panels: CPP-UDDM-SL (Modular, Flat)

6) Patch Cords: CPC2272

d. Superior Essex/Ortronics

1) Plenum Cabling: DataGain - 66 Series Cable CMP

2) Indoor/Outdoor: N/A

3) OSP Cabling: 04-001-68

4) Jacks: Clarity OR-TJ600-xx

5) Patch Panels: OR-401045292 (Modular, Flat)

6) Patch Cords: OR-MC6xx-xx

2. 10Gb/s Category 6A Solution (Minimum Compliant KEYSTONE JACKS) (For Wireless Access Points)

a. Mohawk/Belden

1) Plenum Cabling: XGO CMP M58781

2) Indoor/Outdoor: N/A

3) OSP Cabling: LAN-Trak M59198

4) Jacks: 10GX AX102xxx

5) Patch Panels: AX103121 (Modular, Flat)

6) Patch Cords: CA2110x0xx

b. General Cable/Panduit "NetKey"

1) Plenum Cabling: GenSPEED 10,000 CMP

2) Indoor/Outdoor: N/A

3) OSP Cabling: N/A

4) Jacks: NetKey NK6X88Mxx

5) Patch Panels: NKFP48Y (Modular, Flat)

6) Patch Cords: NK6APCxxM

c. CommScope

1) Plenum Cabling: CS44P

2) Indoor/Outdoor: N/A

3) OSP Cabling:

4) Jacks: 6830 5 835-XX

5) Patch Panels: UNP-6A-DM-1U-24 (Modular, Flat)

6) Patch Cords: UNC10G

d. Superior Essex/Ortronics

1) Plenum Cabling: 10Gain – 6A Series Cable CMP

2) Indoor/Outdoor: N/A

3) OSP Cabling: 04-001-A4

4) Jacks: Tech Choice OR-KT2J6A-XX

5) Patch Panels: OR-SPKSU48 (Modular, Flat)

6) Patch Cords: OR-SPCA6Axx-xx

B. Cabling: 100-ohm, four-pair UTP, binder groups covered with a thermoplastic jacket.

1. Color: Coordinate cable colors with owner prior to sending submittals.

2. Comply with ICEA S-90-661 for mechanical properties.

3. Comply with ANSI/TIA -568-C.2 for performance specifications.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

C. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher. Cables shall be terminated T-568-B.

D. Modular Patch Panels: Flush mount modular patch panels in 24 port 1U or 48 port 2U configuration equipped with rear mounted faceplates to allow jack modules to be flush with front of patch panel.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

1. Color: Jack colors shall be selected by IDF the cable originates from. Coordinate IDF color scheme with owner.

F. Face Plates: Faceplates shall accept modular 8 position/8 conductor information jacks.

1. Color, finish, and design shall be off-white, E/I, or building location requirements.

2. See drawings for faceplate configurations.

G. Patch Cords: Factory-made, four-pair cables in various lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots.

2. Patch cords shall have latch guards to protect against snagging.

3. Patch cord lengths shall be no longer than required for the application.

2.04 *Coaxial Cable*

A. Manufacturers: Subject to compliance with requirements, provide products by General Cable/Panduit, or one of the following approved manufacturers:

1. General Cable with Panduit Connectivity

2. Superior Essex with Ortronics Connectivity

3. Mohawk with Belden Connectivity

B. General Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.

1. No. 14 AWG, solid, copper-covered steel conductor.

2. Gas-injected, foam-PE insulation.

3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.

4. Jacketed with sunlight-resistant, black PVC or PE.

5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85°C.

D. RG-6/U: NFPA 70, Type CATVP or CMP.

1. No. 18 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.

2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.

3. Jacketed with black PVC or PE.

4. Suitable for indoor installations.

E. NFPA and UL compliance listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV or CATVP.

2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.

3. CATV Riser Rated: Type CATVP, complying with UL 1666.

F. Hardware

1. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.05 *Telecommunications Outlet/Connectors*

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA-568-C.1.

B. Workstation Outlets: Two or Four port-connector assemblies mounted in single or multi-gang faceplate.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."

2. For use with snap-in jacks accommodating any combination of UTP and coaxial work area cords.

a. Flush mounting jacks, positioning the cord at a 45-degree angle.

3. Legend: Machine printed, in the field, using adhesive-tape label.

2.06 *Grounding*

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with ANSI/TIA-607.

2.07 *Identification Products*

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

B. Comply with ANSI/TIA-606-B and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.08 *Source Quality Control*

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables on reels according to ANSI/TIA-568.1-D.

C. Factory test UTP cables according to ANSI/TIA-568-C.2.

D. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 *Wiring Methods*

A. Install cables in pathways except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

2. Install lacing bars and distribution spools.

3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 *Installation of Cables*

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with ANSI/TIA-568.1-D.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminal TIAs, cross-connects, and patch panels.

5. Cables may not be spliced.

6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

10. Cold Weather Installation: Bring cable to room temperature 68°F for 48 hours before de-reeling. Heat lamps shall not be used for heating.

11. In the communications equipment room, install a 10-foot long service loop on each end of cable.

12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with ANSI/TIA-568-C.2.

2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wire way or pathway at a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.

3. Cable shall not be run through structural members, on structural members (including bottom flange of joists), or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and ANSI/TIA-569-BD for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.03 *Firestopping*

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with ANSI/TIA-569-BD, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.04 *Grounding*

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI/TIA-607-C.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.05 *Identification*

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-B. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

1. Administration Class: 3

2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.

C. Paint and label colors for equipment identification shall comply with ANSI/TIA-606-B for Class 3 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA-606-B. Furnish electronic record of all drawings, in software and format selected by Owner.

F. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Exposed Cables and Wire Troughs: Label each cable at intervals not exceeding 15 feet.

4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.

b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-B.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.06 *Field Quality Control*

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568.1-D.

2. Visually confirm Category 6 Category 6A marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. UTP Performance Tests:

    a. Test for each outlet. Perform the following tests according to ANSI/TIA 568.1-D and ANSI/TIA-568-C.2:

        1) Wire map.

        2) Length (physical vs. electrical, and length requirements).

        3) Insertion loss.

        4) Near-end crosstalk (NEXT) loss.

        5) Power sum near-end crosstalk (PSNEXT) loss.

        6) Equal-level far-end crosstalk (ELFEXT).

        7) Power sum equal-level far-end crosstalk (PSELFEXT).

        8) Return loss.

        9) Propagation delay.

        10) Delay skew.

6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

    a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.

b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. The General Contractor shall ensure that the painting contractor does not paint or over spray any single 4 pair horizontal telecommunications Category 6 or cable. Any painted or over sprayed cable shall be replaced at the painting contractor's expense. Painted Cable will not be covered as part of an extended warranty.

G. Prepare test and inspection reports.

3.07 *Demonstration*

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 26 95 00

Appendix A

Construction Plans